IMPLEMENTATION OF P.L. 96-480 STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

HEARINGS

(Including an analysis of the Hearings prepared for the Subcommittee by the Congressional Research Service)

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

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*On assignment to Budget Committee for 97th Congress.

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ANALYSIS OF THE HEARINGS RECORD

CONGRESSIONAL RESEARCH SERVICE,
THE LIBRARY OF CONGRESS,
Washington, D.C., December 15, 1981.

Hon. DOUG WALGREN,
Chairman, Subcommittee on Science, Research, and Technology,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: I am pleased to forward the enclosed report entitled, "Analysis of Oversight Hearings on the Implementation of P.L. 96-480, The Stevenson-Wydler Technology Innovation Act of 1980," undertaken at the request of the Subcommittee on Science, Research, and Technology. the paper was prepared by Wendy H. Schacht, Specialist in Science and Technology, of the Science Policy Research Division.

This study both summarizes and analyzes the testimony presented at the July 1981 hearings on the implementation of P.L. 96-480. It offers an indication of how the 28 witnesses view the Federal Government's efforts at meeting the requirements of the law. It is hoped that this analysis will assist the subcommittee in its oversight function.

On behalf of the Congressional Research Service, I would like to express my appreciation for the opportunity to undertake this timely and challenging assignment.

Sincerely,

GILBERT GUDE, *Director.*

ANALYSIS OF OVERSIGHT HEARINGS ON THE IMPLEMENTATION OF PUBLIC LAW 96-480—THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

(By Wendy H. Schacht, Specialist in Science and Technology, Science Policy Research Division)

I. INTRODUCTION

On July 14, 15, and 16, 1981, the House Committee on Science and Technology, Subcommittee on Science, Research, and Technology held oversight hearings on the implementation of Public Law 96-480, the Stevenson-Wydler Technology Innovation Act of 1980. This law, signed October 21, 1980, is designed to "promote United States technological innovation for the achievement of national economic, environmental, and social goals" by: (1) establishing organizations within the executive branch to study and stimulate technological innovation; (2) promoting technology development through the creation of centers for industrial technology; (3) stimulating improved utilization of federally funded technological developments by State and local governments and the private sector; (4)

providing encouragement for innovation through the recognition of individuals and companies which have made outstanding contributions in technology; and (5) encouraging the exchange of scientific and technical personnel among academia, industry, and the Federal laboratories.

In his opening remarks, Chairman Doug Walgren noted that "the Subcommittee's objective in the innovation and productivity program . . . is to help ensure that science and technology make as substantial and as great a contribution as possible to our economic health." (1)[1] The passage of Stevenson-Wydler was the major result, to date, of the continuing congressional interest in innovation and economic growth. As such, the committee has a critical interest in the central issues of: (1) how Public Law 96-480 is being implemented by the Federal departments and agencies; (2) what are the opinions of industry, professional societies, Congress, academia, and State and local governments regarding the need for implementation of the Act and their view on how well the Federal agencies are meeting the law's mandate; and (3) what additional activities can the Government undertake to achieve the objectives of Stevenson-Wydler. (2)

Twenty-eight witnesses from Government, industry, professional associations and academia were asked to participate. The list of participants is as follows:

Mr. Joseph R. Wright, Jr., Deputy Secretary of Commerce with Dr. Ernest Ambler, Director, National Bureau of Standards and Mr. Melvin Day, Director, National Technical Information Service.

Senator Harrison Schmitt.

Mr. Douglas D. Danforth, Chief Operating Officer, Westinghouse Electric Corporation.

Mr. Barnard M. Sallot, Director, Professional and Governmental Activities, Society of Manufacturing Engineers.

Mr. William F. Mericle, Group Vice President, Cincinnati Milacron, Inc.

Dr. Jordan Baruch, former Asst. Secretary of Commerce for Science and Technology.

Senator Charles Mathias.

Dr. John Slaughter, Director, National Science Foundation, with Mr. Donald Senich, Director, Division of Industrial Science and Technology and Mr. Edward Kelly, Head, Intergovernmental Programs Section.

Mr. Harold Jacobsen, Mayor, Carson City, Nevada.

Dr. Narinder Kapany; Director of Innovation Center at University of California, Santa Cruz.

Ms. Patricia Hendel, Vice President, Board of Trustees, New England Innovation Group, Inc., accompanied by Robert Cox, Director, New England Innovation Group.

Mr. Anson Bertrand, Director, Science and Education Administration Department of Agriculture with Dr. Theodore J. Maher, Cooperative Extension Service.

Ms. Antionette Joseph, Office of Energy Research, Department of Energy.

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[1] Numbers in parentheses refer to pages in this volume.

Mr. Al Linhares, Director of Technology Sharing, Department of Transportation.

Mr. Floyd Roberson, Director, Technology Transfer Division, National Aeronautics and Space Administration.

Col. Elbert W. Friday, Jr., Acting Director, Research and Technical Information, Office of the Under Secretary of Defense for Research and Engineering, Department of Defense.

Dr. Frank D. Verderame, Acting Assistant Director of Army Research, U.S. Army.

Dr. Alan Berman, Director of Research, Naval Research Laboratory, U.S. Navy.

Capt. David F. Parrish, Asst. Deputy Chief of Naval Material for Laboratory Management, Headquarters Naval Material Command, U.S. Navy.

Col. Thomas R. Ferguson, Jr., Asst. Director of Laboratories, Air Force Systems Command, U.S. Air Force.

Dr. Eugene E. Stark, Jr., Chairman, Federal Laboratory Consortium for Technology Transfer.

Mr. Richard Eckfield, Chairman, Technology Transfer Society task force on implementation of Stevenson-Wydler Act.

II. OVERVIEW

Public Law 96–480, the Stevenson-Wydler Technology Innovation Act of 1980, was passed in response to congressional concern over the level of innovation and technological development in the United States both in terms of past U.S. performance and in relation to other industrialized nations. The law, which received bipartisan support in both the House and the Senate, provides various executive branch initiatives designed to improve innovation, productivity, and technical development in the industrial sector. These initiatives were the result of several years of study by both executive and legislative units including the Domestic Policy Review on Industrial Innovation (undertaken by the Carter Administration) and a series of hearings in the House and in the Senate.

The purpose of the law is to "improve the economic, environmental, and social well-being of citizens of the United States" through technology and industrial innovation. To meet this objective, Stevenson-Wydler provides the Federal Government with responsibility for encouraging innovation. In doing so, it gives lead agency responsibility to the Department of Commerce, which is directed to create an Office of Industrial Technology to study and stimulate technological development. As part of this initiative, Commerce is mandated to establish Centers for Industrial Technology. These centers are to be affiliated with universities or other non-profit organizations in order to provide research and development cooperation between universities and industry and to develop a generic technology base in the Nation. Similarly, the National Science Foundation is directed to establish such Centers for Industrial Technology. The Commerce Department also is required to create a National Industrial Technology Board to provide a forum for interaction and cooperation between the public and private sectors in the area of innovation.

The concept of technology transfer was promoted in Public Law 96–480. Section 11 of the law requires agencies to establish Offices of Research and Technology Applications (ORTA) at all Federal laboratories to promote the transfer of technology to State and local governments and to the private sector. Technology transfer is defined specifically in the law to include four functions: (1) assessments of the applicability of current projects to other areas; (2) information dissemination; (3) cooperation and assistance to the Center for the Utilization of Federal Technology (CUFT) and other networking organizations; and (4) technical assistance in response to requests from State and local officials. To assist in technology transfer, Stevenson-Wydler directs the Department of Commerce to establish the Center for the Utilization of Federal Technology as a clearinghouse for the transfer of information, to coordinate the activities of the ORTAs, to interface with the Federal laboratories and other networking organizations, to receive requests for technical assistance from State and local jurisdictions, and to do whatever else is necessary to transfer technology from the Federal Government to the private sector.

The law also provides for the award of a National Technology Medal to individuals or companies for outstanding contributions to the area of innovation.

Public Law 96–480 became law on October 21, 1980. Nine months later, the House Committee on Science and Technology, Subcommittee on Science, Research and Technology, held oversight hearings to ascertain how the law was being implemented. Representatives from the relevant Federal departments and agencies testified as to their compliance efforts. Witnesses from industry, academia, and other organizations in the private sector provided their informed opinions as to the extent to which the Government is meeting the mandate of Stevenson-Wydler.

The general indication is that the law is not being implemented as envisioned by Congress. Between the passage of Public Law 96–480 and the hearings, there was a change in administrations. The policies of the Reagan Administration are apparently at odds with the approach mandated in Stevenson-Wydler. As was noted at the hearings, the Reagan Administration's approach to innovation is based upon (1) tax incentives for industries to engage in technological development; (2) reduction in Federal regulations; and (3) less Government involvement in the marketplace. Thus, the Deputy Secretary of Commerce stated that those programs in Stevenson-Wydler which require outlays of appropriated funds would not be implemented. The result of this is that the Department of Commerce will not have an Office of Industrial Technology nor will it create or fund Centers for Industrial Technology (the cooperative generic technology center concept). The National Science Foundation will provide decreasing support for such centers. The "responsibility" for the Center for the Utilization of Federal Technology has been shifted to the National Technical Information Service, which soon may be discontinued. In any case, the program planned within NTIS does not appear to meet the requirements as stipulated in section 11. The status of the National Industrial Technology Board and the National Technology Medal are unclear.

Department of Commerce witnesses provided testimony that they were in the process of reorganizing the Department and that the technology and innovation components would be merged with the economic activities of the Department. This reorganizational process, in effect, acknowledges the interrelationship between economic activities and innovation that Stevenson-Wydler, in part, attempts to strengthen. However, the responsibilities of the Department of Commerce in the innovation area will be limited to data collection and distribution, according to Administration witnesses. This apparently precludes the operation of the "active" innovation and technology development efforts mandated in Public Law 96-480. This also brought strong objections from other witnesses and committee members who asserted that the time for simple data collection and dissemination is past. What is necessary, according to several of the representatives from the private and public sectors and several committee members, is some form of stimulative action by the Federal Government. These witnesses believe that the initiatives in Stevenson-Wydler, resulting from extensive study in the area, at least provide a supportive role for the Government in improving the state of U.S. industrial innovation.

Some of the strongest criticisms of the Department of Commerce came in response to its decision not to establish the cooperative generic technology centers program. It was pointed out that the relationship between industry and Government has developed into an adversarial one in some respects and that the Centers concept was one mechanism to develop a cooperative spirit between these two sectors, as well as between industry and the university community. It was also noted that there is a real need for technological development in generic areas where one company or industry would be unable or unwilling to fund and perform necessary research.

The programs that were mandated in the Department of Commerce, and the Centers for Industrial Technology at the National Science Foundation, require appropriations to be operational, and thus they appear to have been terminated in the absence of such funds. However, the major portion of section 11, dealing with technology transfer from Federal laboratories to State and local governments and the private sector, does not require additional money. Instead, section 11 stipulates that each Federal laboratory create an Office of Research and Technology Applications; that each laboratory with a total annual budget in excess of $20 million have at least one full-time professional staffing the office; and that 0.5 percent of an agency's R&D budget be utilized for technology transfer activities (the personnel and funding provisions may be waived, but not the requirement to establish ORTAs in the laboratories).

Generally, the agencies testified that they would comply with the law concerning the creation of Offices of Research and Technology Applications, although the staffing and funding requirements may be waived. The Department of Defense has requested that such a waiver be granted, although the spokesman indicated that this was not to imply that DOD did not support technology transfer. The witness stated that the Department of Defense spends a comparable amount of money on transfer activities and the waiver would allow the Department flexibility in meeting its basic defense mission. The Departments of the Army, Navy, and Air Force have been directed to establish ORTAs in their laboratories. Several other agencies indicated that previously established organizational units would be utilized to serve the ORTA function. However, testimony presented by the Department of Energy implied that each laboratory may not be required to comply with the law. The witness from DOE noted that the Department's plans may include the creation of Offices of Research and Technology Applications in DOE laboratories. It was pointed out by the committee that the agencies are required to establish such offices and that, while funding and staffing requirements in laboratories over $20 million (annual budget) may be waived, the ORTAs could not be.

What remains unclear after the testimony was presented is whether there is a delineated, top-level commitment in all departments and agencies to accept the concept of technology transfer, to integrate it in policy, and to utilize the Offices of Research and Technology Applications as directed by the Congress. Most of the departments have some technology transfer structure—either dedicated to information dissemination or technical assistance. While the agencies stressed that they were in the process of creating, or had established, ORTAs it remains to be seen whether the four functions defined as technology transfer are actually incorporated into the operations of the designated offices.

Several executive branch activities raise the question of whether or not there is a real commitment to technology transfer in the Administration. The National Science Foundation provided testimony that it was meeting the mandate of Stevenson-Wydler through its industrial innovation programs. Yet, at the same time, its Intergovernmental Science and Public Technology program, which had been transferring technology to State and local jurisdictions for over ten years, was eliminated. The NSF Innovation Centers program also was discontinued. Similarly, at the Department of Commerce, the Center for the Utilization of Federal Technology, which was designed to transfer technology from the Federal Government to State and local jurisdictions and the private sector, will not be funded such that it can carry out its mandated functions as delineated in Public Law 96-480.

In summary, the oversight hearings seem to indicate mixed results for the implementation of Stevenson-Wydler. The programs which require the outlay of specific appropriations for their operation have been eliminated by the Reagan Administration. In particular, the Department of Commerce has discontinued the Office of Productivity, Technology, and Innovation, will not create or fund the Centers for Industrial Technology, and will not operate the Center for the Utilization of Federal Technology as outlined in the law and accompanying Committee Report (No. 96-1199). Similarly, the National Science Foundation will not establish the cooperative generic technology program mandated in Public Law 96-480. Commerce indicated that decisions had not been made concerning the disposition of the National Industrial Technology Board and the National Technology Medal.

The departments and agencies which testified provided the impression that they were going to comply with the mandate of Public Law 96-480 to establish Offices of Research and Technology Applications. Some of these agencies will utilize existing organizational structures to accomplish this. However, it remains unclear whether the ORTAs will operate to meet the functions delineated in the law. In most of the agencies, these offices are not yet operational, or have not been functioning a sufficient time to judge adequately the effectiveness of their efforts. The continued oversight of the House and the Senate was suggested as a mechanism to ensure that the executive branch meets its responsibilities as defined in the Stevenson-Wydler Technology Innovation Act of 1980.

III. THE ROLE OF PUBLIC LAW 96-480 IN INNOVATION

A. Purpose of Stevenson-Wydler

The passage of Stevenson-Wydler came in response to, as William Mericle noted, the widely perceived realization that U.S. industry no longer occupied the dominant position it once had in the world marketplace. (153) The law ". . . very effectively defines the problem of productivity, and equally effectively assembles the voluminous data gathered to construct the rationale for the preliminary attack on the problem of U.S. productivity," according to Bernard Sallot. (175) Throughout the process of congressional activity leading to the development and passage of Public Law 96-480, there was general agreement on the importance of science and technology to continued U.S. economic growth. This concept was reiterated in these oversight hearings. Senator Harrison Schmitt testified that the science and technology base represents ". . . the critical marginal advantage on which our economic competitiveness, our national security and our well-being depend." (86) The lead over other industrial countries which we once enjoyed can no longer be taken for granted for, as Schmitt enumerated:

"Our educational system yields proportionally fewer scientists and engineers than many of our competitors . . . our universities and industries have become generally isolated from one another . . . in part, this isolation has resulted because of direct Federal support of academic research, which has displaced that which formerly came from industry and various foundations. Our national laboratories have emerged as major centers of research and development, for which there are few mechanisms for transferring the technology to the private industrial and commercial sectors." (86)

Both Mr. Mericle and Mr. Douglas Danforth concurred with the assessment that the United States is losing its competitive edge. As Danforth observed, "other countries, more disciplined in their economic policies and more enlightened in their use of resources, have been catching up to us." (113) This has resulted in, Mr. Danforth maintained, a decline in the U.S. share of world exports—from 40 percent in 1950 to 15 percent in 1980. (113) Foreign manufacturers have penetrated U.S. markets while U.S. manufacturers, with notable exceptions, have been unable to break into foreign markets. (113) In addition, Danforth remarked, ". . . it's an indisputable fact that the United States is dead last in productivity growth rate, compared to all modern industrialized nations in the last decade." (114) He also noted that the ratio of U.S. R&D expenditures to Gross National Product lags behind previous levels. According to his information, this ratio has decreased nearly 24 percent over the past 15 years. (116)

Mr. Mericle also expressed concern over the technological position of the United States. He commented that:

". . . The loss of the technological lead, which American industry enjoyed for most of this century, has had very serious consequences. It has been followed by a serious slippage in the competitive standing of U.S. industry in the world economy; and it is also one of the principal factors responsible for the lag in industrial productivity." (153)

While high technology sectors are still producing innovative products and processes, the mature industries have failed to keep up with this growth. (154) Thus, Mr. Mericle suggested that different strategies are needed to address the various types of industry:

". . . In the most innovative, technologically-intensive industries, our primary purpose should be to maintain, protect, and extend our current lead. In mature technology industries, on the other hand, we have to reestablish a technological lead." (154)

That there had been a ". . . significant erosion in the U.S. share of the world trade in manufacturing . . ." is evident to Mr. Mericle. (154) The only response to this problem is, in his estimation, to advance U.S. research and development which will lead to improved technology and superior products. (154) Danforth agreed. According to his testimony, the future vitality of the United States is dependent on the development and application of science and engineering. (113) In this regard Congressman Joe Skeen affirmed that:

". . . The cutting edge of the industrial effort that we have in the United States is our technology, and for far too long I think that we've been intimidated by our own technology because it has led us to become a very affluent nation. We've been apologizing for this for too many years now, and it's about time that we began to believe in ourselves once again. And the only support, the base support, of that is our technological expertise." (246)

In recognition of the importance of science and technology to innovation, Stevenson-Wydler has as its purpose, Congressman Wes Watkins pointed out, the dissemination of technology. (153) As Congressman George Brown and Mayor Harold Jacobsen discussed, what is necessary is a bridge between the producer and user of technological information and know-how. That, Mr. Brown stated, was ". . . a key point in this whole legislation . . ." (284) Senator Charles Mathias concurred on the significance of science and technology. He observed that ". . . one of the most important products of America is our scientific and technological success." (234) However, Senator Mathias noted, ". . . in this area of American science and technology we are a little bit [in] the case of the shoemaker's children." (234) The United States has vast quantities of technology which other nations are willing to purchase and utilize, "but we very often don't make it available to our own people in a convincing and in a convenient and in an economical way." (234) As the Senator remarked Public Law 96-480 is designed to promote this purpose:

". . . at the moment I think it is absolutely critical, because we are in a period of deemphasizing federal programs; we are in a period of reemphasizing the activities of the private sector. And if the private sector is to be able to shoulder in an efficient and productive way the kind of burden which is being thrust upon them, whether they want it or not—and I think sometimes they say they want it but are a little reluctant to pick it up—they are going to have to have access to this warehouse of knowledge, this warehouse of technological expertise. Thus, I would hope that we would, by using the Technology Innovation Act of 1980, make the keys to the warehouse more available." (234–5)

A similar sentiment was expressed by Mayor Jacobsen. He testified that, as a result of Federal budget and program cuts, it is necessary to be able to utilize new technology to find new ideas. (285) In his opinion, "it makes little sense . . . to spend billions to acquire new knowledge, new technology, and then put it on the shelf and hope that someone will be able to find that information and put it to practical use." (285) There are few benefits to be derived from developing a product when it is not utilized. (278) Especially important is the transfer of technology to the private sector. Mayor Jacobsen indicated that State and local officials are ". . . attempting to phase out the Federal participation in public technology . . . and the way to do that is to get it from the private sector. But if the private sector doesn't understand and can't get the information, then they're not going to go along with that." (278)

B. Reagan administration plans for the implementation of Stevenson-Wydler

According to the testimony presented, the Reagan Administration apparently is unwilling to support many of the provisions of Public Law 96–480, especially those which concern the Department of Commerce and the National Science Foundation. As Deputy Secretary of Commerce, Joseph Wright maintained, the Administration would not support initiatives which require the outlay of appropriated funds. (35) The current Administration's activities to promote innovation instead are concerned primarily with: (1) tax incentives; (2) a reduction in Federal regulations; and (3) less Government interference in the marketplace. The program, as Deputy Secretary Wright presented it, would be a comprehensive effort:

". . . to reverse the adverse trends in productivity and technology innovation by restoring an economic environment in which there can be real and substantial returns for working, saving and investing. This, of course, includes a policy of reduced Federal expenditures, a program of regulatory reform; a stable monetary policy that encourages long-term planning and investment; a tax policy that provides incentives for modernizing our industrial/manufacturing base, expands research and development and increases the incentives to save and invest. The President's program should encourage the marketplace to provide the funds for industry to under-take needed innovations." (29)

Senator Schmitt observed that this administration has ". . . very different ideas about how to stimulate our economy and ensure our national security, as well as on the appropriate role of Government in promoting innovation and productivity." (88) Both Congressman Brown and Senator Mathias expressed the belief that part of this may be the perennial issue of "not invented here" as each new Administration attempts to implement its own policies and practices. (236)

A more broad based approach was counseled by several participants in the hearings. For example, Chairman Walgren asserted that there are no absolutes in this area and that the Administration should understand ". . . the drawbacks of an absolute approach based on philosophy and spirit." (229) Mr. Brown communicated a similar concern. Noting that while he believes that the Administration recognizes that a problem exists, he nonetheless is concerned that:

". . . they feel, as the past Administration felt, that their particular political solution has all the answers to it. I wonder if that course has to run, and they have to have their program in place for a couple of years to see that it hasn't solved all the problems before they will be willing to accept a program which is fairly consistent with their own aims and not inconsistent with their political philosophy. It's a cooperative approach on the part of the American industrial and governmental communities to solve mutual problems and I see nothing inconsistent in that with the President's philosophy." (241)

Senator Schmitt and Congressman Brown concurred on the necessity of having ". . . a broader program, which would have included the better part of whatever the Carter Administration had proposed, as well as many of the initiatives this Administration proposed." (102) The testimony presented by Schmitt indicated that, while Stevenson-Wydler did not constitute a comprehensive approach to technology transfer (88), it ". . . was considered a useful and achievable effort at the time of its passage." (88) While the new Administration is following a different approach to economic stimulation, Senator Schmitt argued Congress can be more selective about what programs it supports and "assist the Administration in getting away from the across-the-board cuts that we have seen and be more specific about where can we effectively assist the private sector in utilizing the technologies developed under Federal auspices." (108) Similarly, Mr. Brown commented that he continues to feel that Stevenson-Wydler:

". . . is a useful policy tool and, as Senator Schmitt pointed out, it may not solve all the problems, but it represents a bona fide effort to move in the proper direction. It's my hope that this Administration, after it gets in place its economic program, which I trust will restore more of the cooperative relationship between government and business, will be willing to see the advantage of vigorously implementing this." (223)

Dr. Jordan Baruch questioned whether the Reagan Administration strategy would be sufficient to ensure increased innovation and productivity. As he testified, the Administration's plans will help industry's willingness to invest in new technology, but not its ability to develop such technology, and both are necessary (238). Acknowledging that it is important to decrease regulation, Dr. Baruch asserted that there are certain activities a company and/or industry will not be able to undertake despite a reduction in regulation. (244) The activities which are promoted under Stevenson-Wydler often do not make any business sense for a firm or industry to attempt on an individual level, thus the necessity of Government serving as a catalyst for a program which will have "enormous" public benefits. (244)

It is also possible, according to Dr. Baruch, to stay within the philosophical framework of the Administration. (243) In his estimation, the restoration of funding for the Department of Commerce programs is important for two reasons. First the implementation of these programs is ". . . an insurance policy in case the Administration's program doesn't have all the answers." (243) It can bolster the Reagan policies. And secondly, "it's a chance to increase the American pie. We keep getting involved in our congressional discussions about how the pie will be split. Here is the most bipartisan of all possible questions—how can we increase the total pie?" (243)

Both Senator Schmitt and Congressman Skeen concurred on the bipartisan nature of the effort. Schmitt noted that it was a concern on behalf of both Democratic and Republican Members of Congress that the U.S. was losing its innovation position vis-a-vis other nations which led to the passage of Stevenson-Wydler (87). Stating that he would ". . . go to bat for the program" at the White House, Mr. Skeen declared that "its not a matter of Republican philosophy or Democratic philosophy; its how do we get out of this mess . . ." (245)

Several witnesses, while agreeing that there are real budget constraints, testified that the activities mandated in Public Law 96-480 can be accomplished while meeting budgetary guidelines. Dr. Baruch acknowledged the need to decrease Federal spending, but he pointed out that ". . . we are talking about numbers that are . . . at least an order of magnitude, a factor of ten below what we know the Japanese Government is spending . . . They are numbers of the order of magnitude which I expect the country of Greece to be spending in 1982 on this same subject." (242) Dr. Baruch contended that the budget cuts must be reversed while, at the same time, staying within the budget ceiling (238).

Similarly, Senator Mathias testified in favor of funding for several of the programs in Stevenson-Wydler despite budget reductions. He maintained that:

". . . as keen as we are on balancing the budget, and I'm keen on it, too, I think there are great advantages to doing that, but I don't think that you can balance the budget and increase productivity and provide for the long-range economic welfare of this country without spending some money somewhere along the line. You have to spend money to make money. This is one of those cases where I think the investment will be returned many, many times to the American people." (235)

Acknowledging that there may be problems due to budget constraints, (89) Schmitt asserted that the figures could be readjusted under the budget ceilings to implement these innovation programs in the Department of Commerce and in the National Science Foundation. (109) Commenting on the importance of section 5(c), the Senator affirmed that he was in full support of its purpose and that he hopes the current Administration will support it also. (90) However, he observed ". . . this Administration so far, as well as the previous one, tends to not look to see where we have already conducted successful experiments in technology transfer—and there have been many. There have been some failures, but there have been some outstanding successes, as well." (103) What is necessary, according to Senator Schmitt, is a targeting of support for technology transfer in those areas in which it does not occur naturally, thus effecting ". . . a far greater bang for the buck." (108)

In this regard Congressman Brown remarked that he was not optimistic that Congress would force the Administration to do what it appears unwilling to do. (241) However, Senator Mathias argued that unless Congress remains committed to the intent of Public Law 96-480, ". . . And, unless through our efforts here in Congress we raise the priority of this project, . . . we are not going to get the benefit that we ought to get for the money that's already been spent." (237) He asserted that the Reagan Administration's emphasis on the private sector and on local government would be best served by the implementation of the provisions of Stevenson-Wydler. (237) Elaborating, Mr. Mathias testified:

"The opportunity is there. There's not millions but billions of dollars worth of scientific knowledge and expertise that belong to the people of the United States. It ought to be used for their benefit either in the public or private sector. But until there is an aggressive effort to move that, the full potential isn't going to be enjoyed." (237)

The witnesses from the private sector generally supported the view that the provisions of P.L. 96-480 should be implemented, although Mr. Mericle and Mr. Danforth appeared to avoid taking a direct stand on this issue and discussed primarily the innovation issue and their company's response to it. Speaking to the Administration's intention not to fund the Cooperative Generic Technology Centers program, Mr. Mericle testified that the deletion of funding for the entire centers program ". . . was an unwise decision." (160) While acknowledging that there were some valid criticisms of the effort, he noted that ". . . it is doubtful that the appropriate response to such objections should be the elimination of the Generic Technology program." (161)

Responding to the Administration's decision to meet the innovation issue by additional study of the topic, Dr. Baruch articulated that what is needed is action, not "analysis paralysis." (239) Mr. Sallot also expressed surprise at the Administration's contention that more study is necessary. (167) In his written testimony Mr. Sallot observed that:

". . . we have more than enough studies, performed by diverse groups and competent people, to define the problem. More preciseness of definition is not needed. As a matter of fact, the U.S. industrial productivity problem has almost succumbed to the 'doctrine of preciseness.' 'Precisely' what is the problem, 'precisely' how do we measure it, 'precisely' what is the solution? 'Preciseness' has become the excuse for non-activity in many quarters."(175)

He also communicated his astonishment and consternation at having to support the implementation of an Act which had already become law. (167) According to Mr. Sallot, the critical element is action:

"We would say if you're on the battlefield in the middle of a fight for your life you don't stop to design a new 40 millimeter shell; you use what you have available. We think this is important in today's climate." (167)

* * * * * * *

"But for heaven's sake, let's not look back in five or ten years from now from a position of fifth rate mediocrity, to say to ourselves that back in 1980 and 1981 we lost the battle—we stooped over dollars to pick up pennies. This is the essence of where we are today." (167)

IV. THE STATUS OF STEVENSON-WYDLER

A. Department of Commerce

1. *Approach and plans.*—Pub. L. 96-480 mandates that the Department of Commerce initiate several programs to promote "technology and industrial innovation [which] are central to the economic, environmental, and social well-being of citizens of the United States." It confers lead agency responsibility for innovation to the Commerce Department. To accomplish this, the law requires that the Secretary of Commerce: (1) establish and maintain an office of Industrial Technology; (2) create Centers for Industrial Technology (Cooperative Generic Technology Centers): (3) establish a Center for the Utilization of Federal Technology (CUFT); and (4) create a National Industrial Technology Board. These activities were designed to encourage improved industry/government; industry/government/university; Federal/State/local government; and Federal/State/local government/industry interactions in the innovation endeavor.

This approach, as set forth in Stevenson-Wydler, apparently is considered by the Reagan Administration to be antithetical to its policy of less government activity in the marketplace. The testimony of Deputy Secretary Wright indicated that the majority of the Department of Commerce programs required under P.L. 96-480 will not be operational due to the absence of funding for their implementation. While acknowledging that Stevenson-Wydler focuses on technological innovation as one factor of increased productivity necessary to maintain the Nation's international competitiveness and its ability to respond to national needs, (22) Mr. Wright stated that the Department of Commerce would not implement every provision stipulated in the law.

Mr. Wright's argument rests upon the assumption that the provisions of the President's economic recovery package address the generic problems associated with innovation and productivity and that the programs included in Public Law 96-480 are too limited and specific to solve the problems. (41) As an example, the Deputy Secretary noted that one of the mandated programs, the Cooperative Generic Technology Centers, is ". . . specifically directed toward individual industries or applications, and we do not believe that we will ever have enough funding to spread across the entire board of American industry all of the specific applications that are needed in order to improve technology and productivity." (41) Instead, Mr. Wright explained, through the implementation of the Administration's tax package and the provision of information ". . . incentives will be there for American business to work with university structures or with whatever private associations they have to do it on their own . . ." (42) He argued that industry will act on its own initiative and that, since tax considerations are important factors in business planning, the Reagan Administration tax package would provide a substantial incentive for business to invest in innovation. (45)

Congressman Brown took exception to this reasoning. He observed that, to date, little has been done in many U.S. industries to improve innovation and productivity and that which is being done may be too late to have sufficient impact. (42) Mr. Brown pointed out that he has:

". . . watched industry sectors 25 years not pick up the ball—the automobile industry, the steel industry, the utility industry. Some of them are just beginning to pick up the ball when they're faced with collapse. In other words, under crisis conditions, they begin to pick up the ball." (42)

The assumption here is that it may be too late for success if a crisis situation must occur before improvements are made in industry.

In lieu of the efforts required by Public Law 96-480, Mr. Wright stated that the Department's activities in this area would concentrate on the collection and analysis of data. (22-3) He contended that "the President's economic recovery program would encourage the marketplace to provide funds for industry to undertake needed innovation . . ." and that the proper role of the Department of Commerce:

". . . has less to do with Federal selection of specific types of commercial technologies for development, and more to do with making sure that we are collecting the right type of pertinent data, and properly assessing, analyzing, and communicating it to the private sector." (22-3)

Mr. Wright indicated that, while budgetary constraints are part of the decision not to fund the initiative mandated by Public Law 96-480, equally important ". . . is our lack of ability at the present time to effectively pinpoint those areas where effective technology and productivity innovation is needed and exactly what are the problems that have caused our productivity to grow at a reduced rate in this country for over 20 years." (40)

Several witnesses and committee Members expressed disagreement with Mr. Wright's contention that more study in this area is needed. Congressman Brown responded to Mr. Wright's testimony saying that he could not:

"believe you're really serious about the need to make further analysis of the factors involved. This has been the subject of intensive knowledge over many years' analysis. And while I don't think that any system of data collection will automatically reveal the answer, you [Wright] have pinpointed most of the answers in your own paper . . . certainly the problem is not basically one of lack of information with regard to the general factors inhibiting our innovation productivities." (40-1)

Concurring, Dr. Baruch commented that the last thing that was needed was more "analysis paralysis" (239) and Mr. Sallot agreed. What is now necessary, according to Mr. Sallot is action. (167) As was discussed previously in this report, both Dr. Baruch and Mr.

Sallot noted that there have been numerous studies in this area and the initiatives mandated in Stevenson-Wydler were based on this large body of knowledge of the innovation environment.

Deputy Secretary Wright discussed that the Department of Commerce was being reorganized to reflect the interrelationship of economic and technical issues:

". . . [We] in the Department of Commerce are planning to consolidate our economic and policy development activities into a single organization, reporting to, as proposed, an Under Secretary for Economic Affairs. We believe that macro-economic policymaking needs to be strengthened by a greater understanding of the factors that influence sectoral or business-by-business economic performance, and we particularly believe that the role of technology has got to be better analyzed and understood in understanding sectoral performance." (23)

He explained that two new programs would be implemented to address the productivity and international competitiveness of U.S. industry: (23) a competitive assessments program and a productivity and technology program. (23) Their operation and function would consist primarily of information gathering and dissemination which would be coordinated with the National Bureau of Standards, the National Technical Information Service, and the Patent and Trademark Office. Coordination also would be sought with the International Trade Administration and the General Counsel for Regulatory Policy. (23) This approach, Wright asserted ". . . is consistent, and actually enhances our ability to deliver on the intent of section 5." (23)

2. *Programs.*—Mr. Wright testified that, while the efforts described above meet the requirements of section 5 of Public Law 96–480, the other provisions of the law are not easily adaptable to the Reagan Administration program and generally will not be implemented as mandated. (23) In regard to section 6, the university-industry cooperative program ". . . runs counter to the spirit of the economic program of reduced Federal expenditures . . ." and will not be funded. (23) Instead, Wright argued that the tax incentives provided in the economic program will encourage the private sector to support industry/university cooperative research with its own funds. (23) Mr. Wright also testified that each Department of Commerce laboratory is being directed to designate an Office of Research and Technology Applications. He observed that ". . . all agencies within the Department of Commerce, which have laboratories, presently expend at least this amount on technology transfer." (24) However, the Deputy Secretary argued that there are not sufficient funds to establish the Center for the Utilization of Federal Technology. [For additional discussion of the CUFT program, see section C of this report.] The Department's alternative is to have the National Technical Information Service (NTIS) publish, distribute, and market information. (24) According to Mr. Wright, NTIS is an active program of technology transfer. As to the disposition of other provisions of Stevenson-Wydler—including the National Technology Innovation Board, the Technology Medal, and NSF/DOC coordination—Deputy Secretary Wright indicated that determinations will be made after the reorganization of the Department is operational. (24)

The decision not to implement the Cooperative Generic Technology Centers (COGENT) program was met by criticism from many of the witnesses and committee Members. The COGENT program would, Baruch commented, provide the forum for industry and government to work together to reduce the adversarial relationship which has developed between the two sectors. (246) The lessening of this conflict should be important to the Reagan Administration according to Dr. Baruch. The activation of the COGENT effort is, Mr. Sallot agreed, necessary to reestablish a cooperative relationship between government and industry:

"It was very difficult to get people to cooperate in the development of any kind of a program that would ultimately lead to greater cooperation of the government, academia, and industry. It does appear that when we finally came down to the difficult home stretch of having such a program, that the partnership that had been so laboriously established between industry and government was broken overnight by government not funding the program." (170)

Mr. Sallot testified that, although the COGENT program may not be perfect, ". . . it should be reactivated and funded as a start in the important direction of technology transfer." (169) It is ". . . a well thought out program, adequately studied and researched by components of the government, industry, academia, and professional organizations." (181) He noted that, in the current environment, companies cannot do up-to-date generic research on their own while simultaneously funding product development. (170) Dr. Baruch supported this assessment. He argued that the Cooperative Generic Technology Center program was visualized to provide industry with the ability to invest in and develop new technology. Its purpose was to utilize:

". . . public funds to create new basic technologies that entire industries can use to improve their products and processes. These basic technologies, or generic technologies as they are called, because they are used by many firms, are not going to be developed by individual firms working alone." (238)

It was Dr. Baruch's contention that one of the primary reasons that the Reagan Administration opposes the COGENT effort is that it is viewed as a grants program. (238) This reasoning is fallacious according to Dr. Baruch, who argued that "it is no more a grants program than is the purchase of new weapons for defense." (238) He observed that both activities spend public funds to get public benefits and that the benefits derived from a cooperative program do not accrue to industry alone, but to society as a whole. (238) To support this Dr. Baruch testified that:

"Mansfield, for example, noted economist, has shown that on the average new technologies and the innovations that grow out of them produce benefits to the public in general that are two and a half times as great, two and a half times as great, (sic) as the benefits that accrue to the individual investors." (239)

Dr. Baruch noted that the Administration's plans will increase industry's willingness to invest in new technology, but not its ability to do so. (238) He maintained that both efforts are necessary and that the Cooperative Generic Technology program is aimed at both activities. A central effort is necessary to apply technical knowledge to develop substitutes for the critical materials we will have to do without. This, Baruch argued, can compensate for the tendency to develop solutions to problems based on the biases of an industry rather than on a broad perspective. As he testified, ". . . when all you have is a hammer, everything looks like a nail." (240) Accordingly, the Administration's program should be supplemented by funding of the COGENT program which provides a missing component of ". . . the Administration's as yet incomplete strategy to stimulate this country's progress in industrial technology." (239) The dollars spent, in Baruch's opinion, ". . . are trivial when compared to the potential public benefits." (239)

Mr. Mericle testified that the COGENT idea can be of tremendous assistance in the mature technology industries. (156) He noted that, in general, a company cannot solve all of its innovation and technical development problems and thus requires such a cooperative effort. (225) However, Mr. Mericle suggested that various modifications in the program be made. He proposed that the centers be industry, not technology-oriented, and observed that they would be most effective in industries where there is much diversity and where there are various small and mid-sized firms. (157) "Such industries require research/innovation facilities which afford great flexibility, are acutely responsive to market forces, and have the capability to integrate advances from a wide range of available technologies." (157) He also suggested close ties be maintained with professional associations, trade groups, and engineering schools; matching industry/government funding, with the eventual phaseout of Federal funds; and an emphasis on training and education. (157)

In general, while Congressman Brown noted that he was pleased that, in its statement, the Department of Commerce supported some of the concepts associated with Stevenson-Wydler, he regretted that funding would not be made available to implement the initiatives. (40) Chairman Walgren also questioned whether the Department was genuinely making an effort at effecting technology transfer, to which Deputy Secretary Wright responded that the National Bureau of Standards and the National Technical Information Service, both part of the Department of Commerce, are performing technology transfer, but that actual monetary support to the private sector is inappropriate for the Federal Government. (43) Mr. Walgren countered that direct support currently is being provided by the Government, and the Department of Commerce in particular, through the National Bureau of Standards, and that such activities are making an important contribution to the U.S. economic well-being. (44) Chairman Walgren continued:

"The point I would like to make, from my point of view, is that in a practical measure, aside from the spirit of this program or spirit of that program, it seems to me we ought to be able to agree on what works and what action makes a contribution. I'm sure we approach these from starting points. I guess I, too, would like to underscore the feeling that I personally have, that this seems to be a needed government effort in that it has not happened in the past, or it has not happened extensively in the past, even at times when certain industries were doing very well.

"And so, to the degree that these efforts do not presently exist in our society, it seems to me that we can't lay that simply on the door of the present tax burden or present depression in the industry." (44)

Mr. Brown questioned Mr. Wright as to whether he would be willing to utilize additional mechanisms to promote innovation and productivity if, after a reasonable period of experimentation, the Administration's effort, based upon data collection and dissemination, did not achieve the desired results. "Or," the Congressman inquired, "shall we let the processes of collapse and rebirth take care of the matter?" (43) Mr. Wright responded:

"Well, the collapse and rebirth is a serious way to be looking at this. But historically, it is a process that has always occurred in certain parts of the economy. I think it now depends on whether or not we feel it's the Federal Government's role to take a socialized approach toward American business." (43)

Mr. Brown took exception to this reference to "socialism." He stated that what was being discussed was not an issue of socializing U.S. industry, but determining what is the proper combination of government-industry interaction. (43)

3. *Role of the Federal Government.*—When Stevenson-Wydler became law, it acknowledged a role for the Federal Government in encouraging innovation in the private sector. As evidenced by the testimony presented by the Department of Commerce, however, questions still remained as to the extent of governmental activities in this area. Responding to a question posed by Chairman Walgren as to whether the government has a role to play in innovation and economic recovery similar to the Japanese approach, Mr. Danforth of Westinghouse testified that the Federal Government should act as a catalyst and sponsor for innovation. (150) Dr. Baruch concurred. He stated that companies generally are unwilling to take on long-term, high risk projects and that this area is one in which the Government should play a role. (244)

The issue of government planning also was raised in recognition of the Japanese Government's extensive use of industrial planning. Congressman Allen Ertel questioned whether it was possible to do this given the political and economic realities within the United States. (151) Mr. Danforth pointed out that there is some government planning being done as a result of the distribution of research grants. (151) He indicates that ". . . those grants are being given because someone [in government] believes that there is an area that's high on the national scale." (151) While he ". . . would be the last to suggest that we violate the individual corporate incentives, because that's what made our country great," Mr. Danforth acknowledged that there were national priorities which the government must promote. (152)

Elaborating on this point, Chairman Walgren observed that this area is different from that generally associated with "planning." He noted that ". . . in the technology and innovation area . . . what we're really talking about is developing opportunities and certainly not engaging in any negative 'you shall not' type planning." (152) Mr. Sallot commented that national planning would not work in the United States. (168) However, he argued that planning would evolve through improved government/industry/university relationships:

". . . it is a generally considered opinion in industry, that if you set up the mechanism whereby people in these segments can be exposed to each other and have the structure to work together, you will then gradually institute a form of planning, which will come from the grass roots level. In that fashion, you will then reach a consensus on what you want to do, and without realizing it, you will emulate the Japanese in their national planning effort." (168)

Mr. Ertel questioned the industry representatives on what appeared to him to be two conflicting industry positions; published statements that the private sector can do it all and testimony that government assistance is necessary. (225) Responding, Mr. Sallot argued that these two positions are not mutually exclusive: "When you talk about the free enterprise system, it just says let us be free to do what we would like to do. But you can't do that without some help." (226) According to Mr. Sallot, the Government must work as a catalyst, not impose an overall planning system. (226) The industrial system is different today and no one company is going to solve the interface problems with another company or industry. (226) There are many grey areas which need to be addressed on a generic basis, Mr. Sallot maintained, and only some force, outside of labor and industy, can catalyze the activities. That is what the Federal Government can do, and that, Mr. Sallot pointed out, is what the competition (meaning other industrialized countries) is doing. (226)

Sallot also asserted that there is nothing wrong with cooperative strategic planning in the area of setting national goals and consolidating the Nation's resources to meet them. (227) However, Congressman Ertel noted, the Reagan Administration is resisting such a role for the Federal Government. (227) According to Ertel, "this Administration sees the Government just withdrawing completely . . . and allowing people to go out there and compete on their own basis and [that] they are going to solve the problems." (227) The Administration's view was corroborated by Mr. Mericle. He testified that the Government should not plan, but rather should make alternative efforts (for example, tax, antitrust) which allow industry to do more in the innovation area (227). This is the approach of the Commerce Department that Deputy Secretary Wright identified in his testimony.

B. National Science Foundation

The National Science Foundation (NSF) presented testimony which argued that the Foundation was in compliance with Public Law 96-480 through its industrial innovation program within the Division of Industrial Science and Technology. Noting that ". . . NSF for well over ten years has been involved in matters that relate very strongly to what is contained in the Stevenson-Wydler Act of 1980," (252) Dr. John Slaughter testified that:

"More specifically, there are a number of activities that are underway to meet the requirements of P.L. 96-480. The programs that the Foundation has put into operation are designed to encourage industry and university interaction, to stimulate innovation, and to help support research in areas that we believe to be very worthy and deserving of support, particularly those in small high technology firms doing high-risk kinds of research activities." (252)

This is being accomplished, according to Dr. Slaughter, through four major programs, including (1) the industry/university cooperative research program; (2) the small business innovation research program; (3) the university/industry cooperative research centers; and (4) the innovation processes research program. (252-3)

To meet the requirements of section 8 concerning the establishment of Centers for Industrial Technology, Dr. Slaughter testified that "our university/industry cooperative research centers program is a movement in that direction . . ." (253) He noted that NSF provides support for the development of broad interdisciplinary research programs at universities through, among other things, planning grants. Several of these have been undertaken and one, the Polymer Processing Center at the Massachusetts Institute of Technology, has become self-supporting. (253)

Dr. Slaughter also announced that in order to meet the mandate of section 11 regarding the establishment of Offices of Research and Technology Applications, the National Center for Atmospheric Research, one of the two centers supported by NSF which have budgets over $20 million has established an Office of Technology Transfer staffed by a "full-time individual." (254) According to Dr. Slaughter, "the other centers also have established such offices and are doing what they can within their missions to see that technology transfer is a conscious decision of the management." (254)

The figures provided by the Foundation in this testimony indicate that $19 million is to be spent in fiscal year 1981 for the programs Dr. Slaughter described. This figure is expected to be reduced to $17 million in fiscal year 1982. Dr. Slaughter concluded by saying: "We believe, however, that important activities are contained in the area of technology transfer and innovation development. The National Science Foundation is committed to identifying and exercising its role in this area . . ." (255)

In his written response to the subcommittee's subsequent written questions, Dr. Slaughter noted that the Foundation's fiscal year 1982 budget request for research and related activities was $956.9 million. In making the determination of the portion to be utilized for technology transfer, the Director wrote that ". . . it is not entirely clear to us precisely how to interpret the term 'technology transfer' as defined in Public Law 96-480 and H. Rept. 96-1199." He stated that ". . . NSF does not support development activities. Hence, generally speaking, it does not 'own' or 'originate' technology that may be transferred to State and local governments or the private sector." However, Dr. Slaughter asserted that the Foundation was involved with activities ". . . designed to strengthen the links between producers and users of research and thus provide conditions under which technology transfer can take place." In the portion of the research budget targeted for technology transfer activities, there is no breakdown made of the intergovernmental science and public technology programs. The figures provided are as follows:

University-Industry Cooperative Research Centers	$1,700,000
Industry-University Cooperative Research Projects	950,000
Innovation Process Research	1,000,000

Small Business Innovation Research Projects	$5,000,000
Technology Innovation Projects	900,000
Engineering Communications Program	400,000
Offices of Research and Technology Applications	[1] (100,000)
Federal Laboratory Consortium for Technology Transfer	[1] (50,000)
Total	9,950,000

[1] Estimates of overhead support costs, not included in total.

In response to additional written questions from Congressman Watkins, Dr. Slaughter indicated that, in order to comply with the President's effort to reduce Federal expenditures, ". . . the NSF budget proposed for fiscal year 1982 does not request funds for a number of programs that are not central to the Foundation's basic mission of supporting high-quality scientific and engineering research." Thus, several programs which met the mandate of Stevenson-Wydler would not now be funded, including the Intergovernmental Programs, the University-Based Innovation Centers, and the Science Faculty Professional Development Program.

The Foundation's contention that it was meeting the mandate of Stevenson-Wydler was questioned by the committee members, as well as by other witnesses. It was noted that NSF has had a program of intergovernmental science and technology for over ten years and that this program has performed the technology transfer functions required under section 11 of Public Law 96-480. The Foundation also provided coordination of the Federal Laboratory Consortium for Technology Transfer to, in Slaughter's words, "encourage the kind of interlaboratory and interagency communication which is very important if, in fact, technology transfer is to occur." (253) Yet despite the indications that the intergovernmental program precisely meets the mandate of the law, Dr. Slaughter acknowledged that:

". . . budgetary actions for fiscal year 1982 reduce many of the activities initiated by NSF and provided a basis for many sections of the Stevenson-Wyder Act. However, we feel, as we did even before the act was passed in 1980, that we should use NSF's basic mission to continue what we believe to be an important effort in technology transfer. (253)

Ms. Patricia Hendel took the Foundation to task for discontinuing the intergovernmental program despite the fact that it had been successfully fulfilling the technology transfer mandate of Stevenson-Wydler. (317) She also expressed disappointment at the Foundation's failure to provide funds for the Federal Laboratory Consortium for Technology Transfer. (316-7) Speaking about the elimination of financial support for the Consortium, Dr. Eugene Stark noted that ". . . in the short term, our networking function would certainly continue. In the long-term, the development of the technology transfer process itself would be hurt badly." (548)

Congressman Wes Watkins took exception to the Director's characterization of the National Science Foundation's programs. He responded to Dr. Slaughter's testimony observing that ". . . many people have felt like the NSF has literally put the technology phase of their program to the back burner and many times its fallen off the back burner . . . its role is not primarily as an active technology transfer agent." (265) He pointed out that the technology transfer mandate in Stevenson-Wydler has four components and that they all must be part of a transfer program. (265) These four include not only information dissemination, but also application assessments of research and development projects within laboratories; cooperation and assistance with the Center for the Utilization of Federal Technology; and the provision of technical assistance in response to requests from State and local government officials. (265)

Mr. Watkins questioned whether the Foundation actually was fulfilling the Stevenson-Wydler mandate. He noted that ". . . whoever does this analysis for you should take it in that perspective of those four functions because they may be misreading or misjudging the Public Law 96-480 section 11 phase . . ." (267)

Dr. Slaughter's response was that the Foundation has been meeting the mandate, and he used the university based innovation centers as an example. (265) According to Dr. Slaughter, the university based programs, while established prior to Stevenson-Wydler, are being expanded to support the intent of the Act. (266) Speaking to this, Mr. Brown conceded that the testimony provided by NSF focused on the broad relationship between the Foundation and technology transfer and that the organization has done an excellent job in this respect. (266) However, he commented that what the committee is concerned with are the specific mechanisms by which to accomplish this transfer of technology. (266) Mr. Brown's skepticism resulted from his observation that:

"Specifically, the Foundation has had that program on intergovernmental science and technology, as you well know, for some time aimed directly at the problem of transferring technology to State and local governments. And that is the wording of the Stevenson-Wydler Act. It's a key component of the Act. And yet that specific program is being eliminated." (266-7)

"Its hard to conceive that the broader and highly important purposes of the Foundation are being focused on the transfer of technology to State and local governments, and I'm quoting from the Act, when you've abolished the program that does that." (267)

Dr. Slaughter argued that the elimination of the intergovernmental program was a result of the Administration budget cuts that made it ". . . necessary that we go back to the basics of the Foundation's program and that the emphasis would be placed upon the support of basic and applied research in the major scientific categories of the National Science Foundation." (267) In other words, something had to be cut and the intergovernmental program was eliminated. That, Mr. Brown asserted, was the point. While, he indicated that he could not fault NSF for doing what the Administration required—although he regretted it—he argued that the Foundation should not try to present what it is doing as carrying out the mandate of Stevenson-Wydler when, in actuality, it has been instructed not to do so. It would, in Congressman Brown's words, ". . . be more realistic to recognize that that program is going to suffer at least temporary diminution and see if we can do something to recoup it later." (267)

Speaking to the Foundation's conduct of its university/industry programs, Dr. Narinder Kapany observed that "unfortunately we now see redirection of Innovation Center [program] funds to safer cooperative research programs. While these are almost sure to suceed, they will have modest impact, at best, on a national scale because they cannot hope to achieve the level of the [Innovation Centers] program . . ." (291-2) He argued that the NSF Innovation Centers activity was both effective and important. (291) It has trained students in the fundamentals of innovation and entrepreneurship and involved them in the actual implementation of what they have been taught. The program has provided for interaction between the university community and the business and industrial sectors. (290)

According to Dr. Kapany, "this is clearly an idea whose time is now." (295) These centers take a different approach to innovation than the usual technical or economic ones. They are people oriented and strive to develop young people in the process of forming career attitudes and goals. Since, Kapany argued, the problems the United States is facing have several causes, ". . . several remedies are appropriate." (295) Yet NSF support is being curtailed. Because of monetary constraints and academic resistance to new technical concepts, universities will not fund the innovation centers without Federal assistance. Thus, Kapany maintained, initial Federal funding is necessary and "a small amount of Federal seed funding will produce considerable activity in fairly short order." (295) The successful operation of the centers would, Dr. Kapany contended, encourage funding from sources outside the Government leading to the eventual demise of Federal assistance. Once the center concept proves to be viable, interest in the idea will increase by which other centers can be leveraged.

C. Section 11 and the Federal Agencies

The purpose of section 11 of Stevenson-Wydler is to provide a mandate for technology transfer from the Federal agencies to State and local governments and the private sector. As Mr. Sallot observed:

"We cannot emphasize too strongly that the ability to transfer technology from one person to another, from one industry to another, and to industry in general is the quickest and most efficient means we have to bring about discernible changes in our rate of productivity improvement. It is technology that advances our products and processes and causes the creation of additional wealth that makes us a stronger nation and improves our competitive position in world markets. It is a potent tool that we can begin to use now. The Japanese learned to use this tool from us and they have used it well, to our current disadvantage. This is one area where emulation of what they have done should be a positive benefit to us." (180)

Similarly, Mr. Richard Eckfield noted that section 11 ". . . is a major step in the accomplishment of [the] goal of effective use of federally funded technological innovation." (557) When combined with other initiatives," . . . section 11 can lead to a major improvement in the effective commercialization of such breakthroughs in technology . . . [and] will lead to formation of new business activity, new jobs, and a revitalization of our innovative capabilities." (557) This section, Mayor Jacobsen pointed out, recognizes the real partnership between State, local, and Federal governments. (285) He asserted that because of budget and program reductions, it is increasingly important to utilize new technology to meet the needs of State and local jurisdictions and the private sector. (285) Ms. Hendel also argued that private sector commercialization is essential in meeting State and local needs and that ". . . the full implementation of section 11 could serve as a type of incentive needed to attract private sector participation in the technology utilization process." (318) Thus, she recommended that Congress require full compliance with the provisions of section 11 (315) and not permit agency waivers. (318)

Congressman Watkins concurred in the necessity of establishing the priority of technology transfers. (107) As he observed, "until we find that's a priority and feel it's a mandate, I don't think that our Government is going to have the role it should in helping stimulate the economy and the productivity of this country . . ." (107) Mr. Sallot expressed a similar conviction regarding the necessity of transferring technology out of the Federal Government so that it can be commercialized and utilized in other segments of society. He commented that: ". . . At the present time there is a huge amount of technology in the Federal laboratories that has not seen the light of day. After all, a basic technology *on the shelf* [emphasis added], that you can translate into a product or a process, adds little to the wealth of this country and adds little to the tax base which many would so widely disperse." (169)

Technology transfer as defined in Public Law 96-480 requires that four types of activities be undertaken within the Federal laboratories:

(1) preparation of application assessments of research and development projects to determine any potential for successful application in State and local government or private industry; (2) provision and dissemination of information on products, processes, or services which have potential applications; (3) cooperation and assistance to the Center for the Utilization of Federal Technology; and (4) provision of technical assistance in response to requests from State or local officials.

This enumeration of what technology transfer entails is designed to ensure that the transfer of knowledge is accomplished on a person-to-person level rather than by relying on information dissemination. As Senator Schmitt testified, "technology doesn't transfer unless people are transferring it' . . ." (101) Mr. Sallot concurred with this statement, noting that ". . . the industrial world recognizes 'hands on' technology transfer as the most significant means of quick increases in productivity." (174) Dr. Baruch also endorsed the concept of technology transfer as person-to-person interface. He testified:

"The transfer of technology is not publishing announcements in a book or publishing notes in NTIS, despite the great regard I have for NTIS; it is not simply a matter of having shows; those all help. What people need to ensure the transfer of technology is adaptation assistance. They need the capability to get people to assist them in adapting that technology to their specific industry needs." (240)

However, Dr. Theodore Maher pointed out that there are several problems and/or barriers to the implementation of the activities mandated in section 11 of Stevenson-Wydler. One of these, he noted, is conflicting priorities when a laboratory is directed " . . . to divert their resources, not only money but oftentimes more importantly, their personnel resources, into secondary applications of research in which they see no direct relevance to the mission responsibility." (398) In addition, Dr. Maher maintained that laboratory personnel generally do not understand the user community. This results in a lack of communication and interaction between producers of technology or technical knowledge and potential users. (398) Other barriers which must be recognized, according to Dr. Maher, are the lack of recognition and understanding by State and local officials of the impact of science and technology (398) and the problem of competition between the laboratories and the business community. (399)

In reviewing the current status of technology transfer as mandated in Stevenson-Wydler, Ms. Hendel stated that many State and local officials are puzzled by the apparently low priority the Government gives to the greater utilization of Federal R&D resources to meet State and local needs. (316) She testified that "no one believing the objectives of Stevenson-Wydler can be pleased with what has happened to its implementation during the first year of its existence." (316) The testimony presented by the Department of Commerce and the National Science Foundation indicated that the technology transfer role assigned to them by Public Law 96–480 will not be fulfilled. Deputy Secretary Wright testified concerning section 11 that the Department of Commerce " . . . wholeheartedly endorse[s] that section to the extent that it can be implemented . . . without the expenditure of additional appropriated funds." (35) He continued, "to the extent that specified CUFT functions require the outlay of appropriated funds, we will not be able to perform them." (37) In describing the Administration's policy will respect to the transfer of technology, Mr. Wright asserted that the procedure was to:

". . . transfer as much *information* [emphasis added] as quickly as possible when it is incidental to R&D work and can be done without direct appropriations. For technology transfer that is not incidential to R&D work and requires financing, we feel that the recipients should pay the transfer costs through user fees." (37)

Several witnesses took exception to the Department of Commerce's plans not to fund the Center for the Utilization of Federal Technology. Mayor Jacobsen stressed the importance of CUFT as " . . . providing an easy point of entry to this vast system of federally derived technologies and information and allow[ing] the Federal Government to respond to inquires in a timely manner." (282) He also maintained that the full implementation of section 11 ". . . would greatly enhance the capacity of State and local government [to] meet the complex challenges in providing public service to communities of the 80's and beyond." (282) Similarly, Mr. Eckfield noted that the role of CUFT was critical: "Effective transfer of technology requires that a central clearinghouse exist and that a single point of entry be established as was envisioned in the establishment of CUFT." (559) Dr. Baruch testified that the failure of the Commerce Department to fund the Center for the Utilization of Federal Technology is a detriment to the technology tranfer process as mandated in Stevenson-Wydler. He observed that:

The Laboratory Consortium Program under the National Science Foundation has performed an important consolidating role in transferring technologies from those laboratories to the public sector and State and local governments. We need the equivalent at the private sector where CUFT was envisioned. (240)

It was noted similarly that the National Science Foundation was discontinuing its Intergovernmental Science and Technology Program and was no longer funding the Federal Laboratory Consortium which Dr. Baruch lauded for its coordination role. (240) Mr. Sallot maintained that the "Federal Laboratory Consortium has done a good job of bringing together a superb group of knowledgeable people to materially assist the technology transfer problem." (179) Like CUFT, the role of the Federal Laboratory Consortium is critical, in Mr. Eckfield's estimation. It is of utmost importance that ". . . inter-laboratory and interagency communications and coordination as provided by the Federal Laboratory Consortium be maintained. This is the vital link which connects users directly to the source of technology. (559)

As a consequence of the NSF cuts in funding for the Federal Laboratory Consortium, Dr. Stark maintained that the Consortium would continue to operate in the short-term, although without additional support the long-term prospects for successful technology transfer as mandated in Stevenson-Wydler would be in question. (548) According to his testimony, the Consortium functions:

". . . To assist these laboratories and the other laboratories to multiply their resources and their effect on the national economy through efficient networking of their capabilities throughout the country, and to provide efficient access for users to the Federal laboratories. In addition to this aggregation, the networking function we develop across laboratories and agencies fosters communication and cooperation among the laboratories and agencies and works to identify and alleviate barriers to technology transfer." (537)

In response to Stevenson-Wydler, the Consortium is now offering to assist laboratories, both members and nonmembers, in understanding and creating a technology transfer function. (538) It also is working with both State and local jurisdictions and the private sector to encourage commercialization and utilization of laboratory technologies. (538)

From the perspective of an organization which has been involved in the transfer of technology, Dr. Stark suggested the need for ". . . a supportive policy on active technology transfer within the Federal agencies at all levels of management." (539) He also asserted that each major Federal laboratory should employ a professional, dedicated full-time to the active transfer of technology, who is in a position within the organization to command the respect and cooperation of the pertinent staff. (539) Of importance to the further development of the transfer process, Dr. Stark suggested that the Congress must demonstrate now that it is interested in Federal agency activities to implement Public Law 96-480. (548) He argued that:

". . . By showing successes based on Stevenson-Wydler, hoping to multiply and expand those successes and develop even greater interest within the Congress, the Administration, and the agencies for the concept of technology transfer, I think that is the most one could ask for. If that were to happen, I think I would feel very good about the results." (549)

Mr. Eckfield provided a similar insight. He maintained that ". . . without some very assertive oversight and prodding . . ." on behalf of Congress, there are ". . . a number of inclinations to just simply do business as usual . . ." (552) He stated that the testimony presented by the agencies at the hearings indicates that, despite the passage of Stevenson-Wydler, the technology transfer efforts of the agencies have not changed significantly. (552) He cited four recommendations for committee action to remedy this: (1) encourage agencies to prepare and disseminate the appropriate directives concerning the transfer of technology; (2) initiate appropriate funding for CUFT and the Federal Laboratory Consortium; (552) (3) ensure that large laboratories have proper, full-time personnel; and (4) continue oversight of Stevenson-Wydler. (553) The importance of section 11, Mr. Eckfield maintained, should not be overlooked:

". . . the fact of the matter is that this small section of this Act might in fact be a key, not to be overly rhetorical about it, but the key that can in fact open a lot of doors in terms of U.S. efficiency, both in the private sector and on the State and local government side." (553)

The following are brief summaries of the testimony presented by various agency representatives on the activities being undertaken to implement section 11 of Public Law 96-480. Also included is additional information derived from written responses to a letter sent by the House Committee on Science and Technology concerning further delineation of agency efforts. (Note: not all agencies have responded at the time of this analysis.)

1. *U.S. Department of Agriculture.*—Technology transfer has been a recognized mission of the U.S. Department of Agriculture (USDA) for many years. (342) As Mr. Anson Bertrand noted, ". . . Public Law 96-480—and particularly section 11—has reendorsed our long standing commitment to emphasizing technology development and transfer through research and extension." (342) He identified the Agricultural Research Service, the Agricultural Extension Service, the Cooperative Research Service, the Forest Service, and the Economic Statistics Service, among others, as providing technology transfer and stated that the USDA ". . . understand[s] the increased emphasis that Congress has placed on this issue and we intend to accelerate our activities in this area." (342)

Mr. Bertrand observed that the Department of Agriculture is decentralized (342) and provides ". . . a constant interactive process between the development of new technology and the user." (342) He acknowledged the importance of technology transfer and noted that USDA ". . . recognize[s] that we must share our research results not only with the business community, which is our traditional client, but also with State and local governments to an extent that we have not done in the past." (343) To this end, Mr. Bertrand testified that, after passage of Stevenson-Wydler, he organized a task force to make recommendations on implementation of its mandate. According to Mr. Bertrand, "to accomplish and utilize the research by private and public users, we certainly support the notion of assessment of relevant research, of technical assistance and of information sharing, and our programs are planned with that in mind." (343)

The figures provided by the Department of Agriculture in response to the subcommittee's letter indicate that the total Science and Education Administration's R&D budget for fiscal year 1982 is $702,657,000 (which includes $10,000,000 for facilities construction at "1890" colleges (a group of Black colleges) and Tuskegee Institute). Of this approximately $317.4 million will be expended for technology transfer by the Extension Service.

2. *U.S. Department of Energy.*—Ms. Antionette Joseph testified that the Department of Energy (DOE) is ". . . actively committed to a sincere effort toward implementing the Act . . . , taking into consideration a number of significant activities in progress, we believe we are already well-along toward meeting both the spirit and the intent of the Act." (353) To support this assessment, Ms. Joseph noted that eight DOE laboratories are members of the Federal Laboratory Consortium for Technology Transfer (353) and that 12 major multiprogram laboratories of the Department ". . . will be the focus of our attention when increasing and improving our technology transfer efforts." (353)

According to Ms. Joseph, "flexible" guidelines are being developed to implement Stevenson-Wydler. In describing these guidelines, Ms. Joseph commented that she expected that they would provide that:

"Each major multiprogram laboratory with an annual budget exceeding $20 million shall establish an Office of Research and Technology Applications [ORTA] staffed by at least one full-time professional; each single-purpose laboratory with an annual budget exceeding $20 million *may* [emphasis added] establish an ORTA if there are sufficient technology transfer opportunities available within the laboratory activities. We will request that the ORTA be funded from laboratory overhead.

"The laboratory shall determine which R&D programs have potential application in State and local governments and the private sector, and prepare appropriate 'Applications Assessments.'

"The laboratory shall propose an annual five-year technology transfer plan showing level of effort and scope of activities. The planned ORTA summary shall be incorporated in the laboratory's annual institutional plan for approval by the Department." (353)

In this regard, it was noted that Public Law 96-480 requires each agency to set up an Office of Research and Technology Applications (ORTA) and that this provision cannot be waived. Ms. Joseph's testimony indicated that each laboratory with a budget over $20 million may establish an ORTA. (353) In response to Mr. Walgren's questioning on this matter, Ms. Joseph asserted that "whether an office has to be set up separately, I think is something that the Act permits us some flexibility on. We can include it within ongoing activities without setting up a separate office." (367) Ms. Joseph also testified that the Department of Energy might request an exception to the requirement of a full-time professional in each ORTA.

According to the figures provided in the Department of Energy's response to the subcommittee's written questions, the estimated fiscal year 1982 R&D expenditures will be approximately $40 million plus $15 million for information dissemination by the Technical Information Center. The breakdown for the estimated expenditures is as follows:

Applications assessments	$4.1
Information dissemination [1]	20.2
Cooperation with technology transfer brokers	1.7
Assistance to public sector	4.6

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[1] This does not include the fiscal year 1982 budgeted expenditure for information dissemination by the Technical Information Center of about $15 million.

3. *U.S. Department of Transportation.*—Mr. Al Linhares testified that "for some time now, the Department of Transportation [DOT] has been active in the technology sharing or transfer process," (370) and that the Department ". . . feels that effective support of State and local governments is especially critical these days, considering the ongoing reassessment of governmental roles, and the financial pressures facing all levels of government." (373) Accordingly, State and local governments are considered ". . . a primary constituency for research and development programs, and the needs of these jurisdictions is now a major consideration in R&D program formulation." (370) In recognition of this, Mr. Linhares indicated that the Department of Transportation sees Stevenson-Wydler as "a focusing" of many DOT activities rather than ". . . a call for large-scale initiation of new projects." (371)

According to Mr. Linhares, the "overall" Department of Transportation program meets the intent and requirements of P.L. 96-480. (372) He observed that the Department far exceeds the financial requirements of section 11 (378) and that "if you take into account those activities that we feel are technology transfer related, we are probably talking ten times the requirement that's called for in the Act." (380) Elaborating on this point, Mr. Linhares noted that DOT has eight facilities which can be classified as laboratories or technical centers. (371) Four of these are active members of the Federal Laboratory Consortium for Technology Transfer. While Mr. Linhares conceded that a specific individual in each laboratory has not yet been identified as a technology transfer agent, he argued that these laboratories perform various functions which meet the intent and spirit of the Act. (378) He also commented that there is an Office of Technology Sharing in the Office of the Secretary which is responsible for carrying out the mandate of section 11. (380)

In the written response for budget figures relating to research, development, and technology transfer it was noted that the fiscal year 1982 budget was not yet approved for the Department of Transportation and that the figures are too "fluid" to adequately answer the questions posed.

4. *National Aeronautics and Space Administration.*—In his testimony Mr. Floyd Roberson indicated that a mandate to perform technology transfer was incorporated into the organic act of the National Aeronautics & Space Administration (NASA) and that many of the agency's activities are designed so that the resultant technologies are transferred into the public sector. (383-4) He stated that NASA has ". . . had for a number of years technology utilization offices at each of the NASA field centers. These offices meet the requirements of section 11 of the Act." (384) These offices

are staffed by full-time professionals who respond to requests from State and local governments and industry. According to Roberson they are also:

"promoting reports of any new technology and innovation, and feeding that information to our dissemination and publication network which provides information to industry" (384)

These offices perform the functions of the Office of Research and Technology Applications (ORTA) required by Stevenson-Wydler and NASA is not planning to change their names. (395)

Mr. Roberson also noted that NASA has a network of ten Industrial Applications Centers which generally are funded jointly with universities. (384) They provide technical assistance and information for problem-solving on a reimbursable basis. The National Aeronautics and Space Administration, Mr. Roberson went on to say, is involved as a broker between other Federal agencies or between the Federal Government and the private sector and assists in prototype technology development. (396) In addition, NASA provides technology transfer through the State Technology Applications Centers, the Computer Software Management Information Center, (389) and the Regional Remote Sensing Applications Centers. (314)

The total fiscal year 1982 NASA R&D budget request is $4,903,100,000 according to the agency's written response. The Technology Utilization amended budget request is $4.6 million, broken down in the following manner:

	Millions
Dissemination and analysis	$2.6
Program support and evaluation	.5
Technology Applications	1.5
Technology utilization	4.6
Technology transfer (remote sensing)	.0

5. *U.S. Department of Defense.*—Col. Elbert Friday testified that the Department of Defense (DOD) considers technology transfer to be ". . . vital to the increased growth and strength of our nation." (441) He noted that DOD has long been involved in the transfer of technology from the laboratories to the non-military sector, and pointed out that the Federal Laboratory Consortium for Technology Transfer (FLC) was an outgrowth of a Defense Department program initiated in the early 1970s. (441) The Department will continue to fund the Consortium, but Col. Friday asserted that he could not commit DOD to additional spending at this time. (519) Overall, he acknowledged the importance of strengthening the United States through economic development and technology transfer and that ". . . the Secretary of Defense and every level of management within the Department of Defense firmly supports that." (520)

In his testimony, Col. Friday identified two actions that the Department has undertaken in response to Stevenson-Wydler. He stated that a waiver of funding and personnel requirements was requested by the Secretary of Defense (441) but stressed that "this is not meant to signify DOD's lack of support . . . [as] DOD substantially complies with the requirements of the Act at the present time." (441) In explaining the DOD position, Col. Friday observed that the $20 billion the Department spends for R&D (515) is ". . . for the most part major systems development . . ." According to his analysis, the laboratory program—budgeted at $3 billion for fiscal year 1981 and $3.5 billion for fiscal year 1982—is what provides the technology options for the future. (441) However, Col. Friday stated, while the Department is in the process of creating an ORTA at each laboratory within the Department:

"DOD technology transfer activities are not and cannot be usefully and effectively distributed through the laboratory system. Consequently, the assignment of one professional at each DOD laboratory which exceeds the threshold established in section 11 would be impractical. Some laboratories have more than one full-time professional staff member assigned to this task. We are in the process of creating the ORTAs at each and every one of our laboratories within the Department." (441-2)

In addition, Col. Friday noted that the Undersecretary for Research conveyed the requirements of Stevenson-Wydler to the Services and requested that each Service develop mechanisms to comply with the law. (442) "In doing so," Col. Friday commented, "we recognize the continuing responsibility of the Federal Government in general and the Department of Defense in particular, to insure the maximum transfer of the results of our research investment to the public and private sectors." (442) The following is a summary of what each Service is doing to meet the mandate of Public Law 96-480.

(a) *Army.*—Dr. Frank Verderame's testimony expressed the assurance that ". . . the Army will seek to develop more efficient and effective means to transfer appropriate Army developed technology to State and local government and the private sector, within the limits imposed by its vital defense mission." (459) To accomplish this Dr. Verderame noted that the Army is involved in various technology transfer efforts including ". . . cooperation with civil sector agencies, both public and private, various exchanges with colleges and universities, presentations of new technological developments at professional society meetings and the participation of many Army laboratories in the Federal Laboratory Consortium for Technology Transfer." (459) He observed that "twenty-three Army laboratories with R&D budgets in excess of $20 million, are served by 21 members of the Consortium." (458) Of these, 13 laboratories have actual FLC offices within the laboratory and eight others have offices within command headquarters. These activities, Dr. Verderame remarked, are governed by Army regulation 70-57 ". . . which is in keeping with the spirit of Stevenson-Wydler." (458) This regulation is now being reviewed to reflect Public Law 96-480. (459)

In addition, Dr. Verderame noted that the Army is preparing to implement the directive of the Under Secretary for Research that Col. Friday mentioned in his testimony. (459) To this end, an Office of Technology and Research Applications or its equivalent will be established in each Army laboratory. Accordingly, "these will systematically do, or have, the functions outlined in the Stevenson-Wydler Act." (459) Each laboratory also will be "strongly encouraged" to participate in the Federal Laboratory Consortium. (459) "However," Dr. Verderame stated, "they will be precluded from doing work which will interfere with the laboratory's performance of the primary mission." (460)

(b) *Navy.*—Dr. Alan Berman testifed that "Prior Navy policy was completely consistent with the Technology Innovation Act, and because of the existence of this policy, the Navy had an organization in place which could comply with the Act." (460) As Capt. David Parrish noted, "the Navy instituted a formal Technology Transfer and Cooperative Development Program in 1972 as a result of successful experimental technology transfer programs organized in the late 1960s and early 1970s." (486) The Navy organized an informal consortium of laboratories in 1970 which has evolved into the Federal Laboratory Consortium for Technology Transfer (486) and has been involved with numerous technology transfer efforts which are summarized in an annual report the Navy publishes on its transfer activities. (483)

According to Capt. Parrish, the Chief of Naval Material is assigned Navy-wide responsibility for technology transfer. (487) In each of the eight Naval Material Command laboratories, a person is assigned technology transfer responsibilities although the ORTA title is not necessarily utilized. (483) Each commander and technical director is being directed to consider the technology transfer potential of each project and, Capt. Parrish remarked, "to ensure that the transfer actually occurs, we include in the commanding officer and technical director annual R&D Center review before the Chief of Naval Material a requirement to present the accomplishments of that center under the Stevenson-Wydler Act." (484) This, Capt. Parrish testified, is an annual event designed as a ". . . management tool under which we can assure an aggressive response to the will of the Congress as regards Stevenson-Wydler." (484)

In addition to his description of the Naval Research Laboratory's efforts in technology transfer, Dr. Berman expressed several concerns regarding the accounting of funds for research and development and technology transfer in the interpretation of section 11. He commented:

"The major laboratories of the U.S. Navy do not have an annual budget. They are funded on an industrial basis. Every dollar administered by a Navy laboratory is provided on a cost-reimbursible basis in satisfaction of a performance contract between the laboratory and an R&D program manager.

"If we accept funds and agree to perform certain services, these funds cannot be used for any other purpose whatsoever. Although overhead charges may be applied to the direct labor portion of the agreed-upon task, the usage to which overhead funds may be applied is very tightly constrained." (462)

Dr. Berman also pointed out that the laboratories receive additional funds from ". . . appropriations such as OMN, SCN, etc. rather than from part 6 (R&D) of the Navy's appropriation." (471) The law, he stated, is not clear as to whether this should be included in the computation of the laboratories' "annual budget." In addition, Dr. Berman noted, the Naval Research Laboratory accepts cost-reimbursable tasking from non-Navy agencies, and it is ambiguous whether these funds should be included in budget figures against which the 0.5 percent for technology transfer activities is determined. (462)

(c) *Air Force.*—Col. Thomas Ferguson, in his prepared testimony, noted that since industry constructs the hardware which the Air Force utilizes, the transfer of technology generally takes place through the work of the contractors. (510) To ensure a more widespread distribution of new technology and technological developments, the Air Force has established a Scientific and Technical Information program (STINFO). The purpose of the STINFO program is ". . . to ensure that (1) scientific and technical information makes the maximum impact on the advancement and development of Air Force technology, and (2) the scientific and technical information generated under Air Force R&D programs makes maximum contribution to the national economy." (511)

In compliance with Public Law 96-480, Col. Ferguson stated that the Air Force Systems Command intends to utilize their STINFO offices to carryout the mandate of the law. (507) These offices will be assigned ". . . an appropriate title to convey the fact that we intend to have them implement the Stevenson-Wydler Act." (507) According to Col. Ferguson, there are 17 people assigned full time and 11 laboratories. The existing technology management review practices in the laboratories will continue to be utilized to meet the requirements for technology transfer assessments of work in progress. (507)

Among other activities, Col. Ferguson noted that the Air Force has used open demonstrations at the end of projects to allow interested parties to view the new technology. (507) Prior to Stevenson-Wydler, notification went to only a selected group; with the advent of Public Law 96-480, the Air Force intends to require that these demonstrations be advertised in Commerce Business Daily to achieve wider notification. (513) The spirit of these programs is, in Col. Ferguson's estimation, in compliance with Stevenson-Wydler, and the Air Force ". . . will continue to seek aggressively to provide opportunities to transfer technology and to provide services as requested from local government agencies." (507)

According to the figures provided in the Air Force's written response, the total fiscal year 1982 R&D budget will be approximately $984 million, of which approximately $6.34 million will be used for technology transfer activities as follows:

	Millions
STINFO/ORTA Function	$6.11
Air Force Information for Industry Office/Air Force Potential Contractor Program	.07
Participation in the Federal Laboratory Consortium for Technology Transfer	.15
Patent Licensing Program	.01

IMPLEMENTATION OF PUBLIC LAW 96-480, THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

TUESDAY, JULY 14, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met at 9:05 a.m. in room 2325 of the Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Present: Representatives Walgren, Brown, Shamansky, Ertel, Heckler, Gregg, and Skeen.

Also present: Representative Wes Watkins.

Staff present: Thomas R. Kramer, Donald Rheem, and Thomas H. Moss.

Mr. **Walgren**. The hearing will come to order.

This morning, the Subcommittee on Science, Research and Technology begins 3 days of oversight hearings on the implementation of the Stevenson-Wydler Technology Innovation Act of 1980.

I would like to welcome the other members of the subcommittee, our witnesses, the press, and everyone else here. We appreciate your interest in the subject, and hope we can spend our time well together.

During the last Congress, the Subcommittee on Science, Research and Technology pursued an extensive program of inquiry on innovation and productivity, under the chairmanship of my colleague from California, George Brown, who is here with us today. I am continuing the program in this Congress, trying to keep the focus of the committee in this direction. The hearings this week are the first hearings in that effort. Mr. Brown is the member most familiar with the act, and he will be both chairing and playing an active role in these hearings.

Later this month, we are sponsoring a seminar in collaboration with the American Association for the Advancement of Science, titled "Innovation and Productivity: A Human Perspective."

In September, this subcommittee will be holding an extensive set of hearings on the same topic, with our colleague, Stan Lundine from New York, who himself has an extensive background in labor management areas, an area we are particularly interested in in this regard.

The subcommittee's objective in the innovation and productivity program, of course, is to help insure that science and technology make as substantial and as great a contribution as possible to our economic health. We have worked hard to be cooperative with the Administration and the Senate in a bipartisan spirit, and we intend to continue to do so. The fact that two of our witnesses are Republican Senators demonstrates that intent.

The Stevenson-Wydler Act was the main legislative accomplishment of the subcommittee's innovation and productivity program in the last Congress. It was named after retiring Democratic Senator Stevenson and retiring Republican Representative Wydler.

The central issues of this hearing are the following:

How is the Stevenson-Wydler Act being implemented by Federal agencies?

What is the opinion of knowledgeable people in Congress, universities, industry, professional societies, and others about the need for implementing the act? And what are their views of how well the Federal agencies are pursuing that direction?

What else, besides implementing the act, can the Federal Government do to achieve these objectives?

Where a person stands on these issues usually depends somewhat on their political view, or the degree to which they believe Government should be directly involved with the affairs of industry.

I think that it is clear, given the sophistication of many efforts in our Government, that there is a great contribution to be made by the Government sector. Certainly, no one would argue that it is the Government's responsibility to be the main engine of innovation. And yet, if we are to have a healthy economic picture in this country, everybody who is able to make a contribution has to make a contribution in that direction.

So it seems clear to me that we have some work to do together. The subcommittee has prepared a paper laying out the issues in more detail; and without objection, this paper will be made a part of the record at this point, including a copy of the Stevenson-Wydler Act.

[The documents follow:]

HEARINGS ON THE IMPLEMENTATION OF THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

JULY 14, 15, 16, 1981

9:00 a.m. - Noon, 2325 Rayburn HOB

ISSUES TO BE EXPLORED

Summary

The central issues are: (1) How is the Act being implemented by Federal agencies?; (2) What is the opinion of industry, professional societies, Congress, academia, and state and local government concerning the need for implementing the Act and what are their views of how well the Federal agencies are implementing the Act?; and (3) What else should the Federal Government do to achieve the objectives of the Act?

We know, generally, that the Department of Commerce has lost almost all of its funding for the Act and that NSF funding has been reduced. We also know that a broad effort is in progress to implement the technology transfer portion (Section 11) of the Act. The hearings should give the Subcommittee a clearer picture of these matters.

Department of Commerce

The Act mandates that the Department of Commerce should establish an "Office of Industrial Technology"; it was established under a different name, OPTI, the Office of Productivity, Technology and Innovation. The Act also directs the Department of Commerce to provide support for "Centers for Industrial Technology"; a program for centers was begun under a different name; COGENTS, Cooperative Generic Technology Centers. The Act requires further that the Department of Commerce establish a "Center for the Utilization of Federal Technology", CUFT; this was done without changing the name. Apparently the Department of Commerce is planning to terminate OPTI, the COGENTS, and possibly CUFT. Many of these initiatives were the result of the Domestic Policy Review on industrial innovation conducted through the Department of Commerce, under the previous Administration. Given this, several questions remain:

(1) Does the Department of Commerce agree with the concepts and issues the Act addresses? Does the Department of Commerce object to the mechanisms Stevenson-Wydler establishes to address the issues?

(2) The Congress made very clear in its findings (Section 2) several policy decisions. How are the programs the Department of Commerce is proposing going to meet the mandate and the intent of the law? What is being done differently now that Stevenson-Wydler is law?

(3) What does the Department of Commerce see as the proper relationship between the Federal Government and the private sector in the area of innovation? Stevenson-Wydler provides for a National Industrial Technology Board. If the Department of Commerce's plan is different than that legislated in Stevenson-Wydler, how can the two be reconciled?

(4) P.L. 96-480 mandates that the Executive Branch study innovation and look at policy (Section 5 (c)). Where and how is this being accomplished? How will duties of the Secretary of Commerce as defined in Section 5 (c) be carried out without OPTI?

(5) What is the Department of Commerce doing to provide for the exchange of scientific and technical personnel among academia, industry, and Federal laboratories and to select nominees for the National TechnologyMedal as required by the Act?

Industry

The COGENTS were established under the Act with the understanding that the type of R&D that they would perform and the form of industry-university-Government cooperation which they would foster could not be accomplished in the absence of a Federal initiative. Does this still hold true? Can the private sector provide such efforts without Federal assistance? What kind of impact will the absence of the Centers for Industrial Technology have on the industries involved? Will the programs of Commerce have similar results as those anticipated from the COGENTS?

What does the cancelation of the COGENT and CUFT programs and the elimination of OPTI indicate to industry about the present and future state of the industry-government relationship?

What impact might be expected if the Department of Commerce does not meet the mandate of the Act as enumerated in Section 5 (c) to study and stimulate innovation in the private sector?

National Science Foundation

The National Science Foundation has been the Agency most active in supporting programs with the same goals as the Act (since before the Act was written). The Act requires the Foundation to support Centers for Industrial Technology, to assist in technology transfer, and to support the exchange of scientific and technical personnel among academia, industry, and Federal laboratories.

Centers -- For several years the National Scinece Foundation has supported two principal types of centers. (1) Industry/University Cooperative Research Centers, which focus on specific technologies (welding and computer aided design, for example) and (2) University-Based Innovation Centers, which train entrepreneurs and help start small businesses. In FY 1982 funding for industry/university centers will be $1.7 million; the President's request for innovation centers is zero. The Subcommittee has encouraged the National Science Foundation to fund the innovation centers and provided funds in the authorization bill.

What is the value of these centers in the witnesses' opinion? Should they be funded?

Technology Transfer -- Through its intergovernmental program the National Science Foundation has provided support for a variety of technology transfer activities for several years (including the Federal Laboratory Consortium, and the New England Innovation Group, for example). Funding for intergovernmental programs has been cut to $1 million in FY 1981 by rescission and they are scheduled for extinction in FY 1982.

What are the merits of these programs? Should they be continued? How can the National Science Foundation fulfill its obligations under the Act if they are cut?

Personnel Exchange -- The National Science Foundation has supported a small amount of industry-academia personnel exchange through its Science Faculty Programs for several years. This has been wiped out along with the rest of science education in the revised FY 1982 request.

What do the witnesses think about the desirability of personnel exhanges? What should be the National Science Foundation's role be?

Technology Transfer

The third day of the hearings is aimed solely at technology transfer; the first and second days deal with technology transfer in part.

Section 11 of the Act mandates that "..,the Federal Government shall strive where appropriate to transfer federally owned or originated technology to state and local governments and to the private sector". (Section 11 (a)) It also states that "the Federal labortories and other performers of federally funded research and development frequently provide scientific and technological developments of potential use to state and local governments and private industry. These developments should be made accessible to those governments and industry. There is a need to provide means of access and to give adequate personnel and funding support to these means". (Section 2 (10))

(1) Agencies

The question to be asked of the agencies is how their programs provide for technology transfer as defined in Stevenson-Wydler and whether they are carrying out the technology transfer activities mandated by the Act. In particular, each agency is required by the Act (1) to establish an Office of Research and Technology Applications in each of its Federal laboratories and (2) to spend at least one-half percent of its R&D budget on technology transfer.

Special responsibilities of the Department of Commerce and the National Science Foundation for technology transfer activities under Section 11 of the Act are discussed under the Department of Commerce and National Science Foundation headings.

(2) Societies

The Federal Laboratory Consortium for technology transfer is specifically named in the Act as a society which should be involved in the technology transfer program of the Act. The Technology Transfer Society is also working to implement the Act. Exactly what are these societies doing, what do they think of the provisions of Section 11, and what do they think of current Administration programs to implement the Act.

(3) Other Views

What do industry, state and local government, and science and technology policy experts think about the technology transfer provisions of the Act and current implementation efforts?

Public Law 96-480
96th Congress

An Act

To promote United States technological innovation for the achievement of national economic, environmental, and social goals, and for other purposes.

Oct. 21, 1980
[S. 1250]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Stevenson-Wydler Technology Innovation Act of 1980".

Stevenson-Wydler Technology Innovation Act of 1980.
15 USC 3701 note.

SEC. 2. FINDINGS.

The Congress finds and declares that:

15 USC 3701.

(1) Technology and industrial innovation are central to the economic, environmental, and social well-being of citizens of the United States.

(2) Technology and industrial innovation offer an improved standard of living, increased public and private sector productivity, creation of new industries and employment opportunities, improved public services and enhanced competitiveness of United States products in world markets.

(3) Many new discoveries and advances in science occur in universities and Federal laboratories, while the application of this new knowledge to commercial and useful public purposes depends largely upon actions by business and labor. Cooperation among academia, Federal laboratories, labor, and industry, in such forms as technology transfer, personnel exchange, joint research projects, and others, should be renewed, expanded, and strengthened.

(4) Small businesses have performed an important role in advancing industrial and technological innovation.

(5) Industrial and technological innovation in the United States may be lagging when compared to historical patterns and other industrialized nations.

(6) Increased industrial and technological innovation would reduce trade deficits, stabilize the dollar, increase productivity gains, increase employment, and stabilize prices.

(7) Government antitrust, economic, trade, patent, procurement, regulatory, research and development, and tax policies have significant impacts upon industrial innovation and development of technology, but there is insufficient knowledge of their effects in particular sectors of the economy.

(8) No comprehensive national policy exists to enhance technological innovation for commercial and public purposes. There is a need for such a policy, including a strong national policy supporting domestic technology transfer and utilization of the science and technology resources of the Federal Government.

(9) It is in the national interest to promote the adaptation of technological innovations to State and local government uses. Technological innovations can improve services, reduce their costs, and increase productivity in State and local governments.

(10) The Federal laboratories and other performers of federally funded research and development frequently provide scientific

and technological developments of potential use to State and local governments and private industry. These developments should be made accessible to those governments and industry. There is a need to provide means of access and to give adequate personnel and funding support to these means.

(11) The Nation should give fuller recognition to individuals and companies which have made outstanding contributions to the promotion of technology or technological manpower for the improvement of the economic, environmental, or social well-being of the United States.

15 USC 3702.

SEC. 3. PURPOSE.

It is the purpose of this Act to improve the economic, environmental, and social well-being of the United States by—

(1) establishing organizations in the executive branch to study and stimulate technology;

(2) promoting technology development through the establishment of centers for industrial technology;

(3) stimulating improved utilization of federally funded technology developments by State and local governments and the private sector;

(4) providing encouragement for the development of technology through the recognition of individuals and companies which have made outstanding contributions in technology; and

(5) encouraging the exchange of scientific and technical personnel among academia, industry, and Federal laboratories.

15 USC 3703.

SEC. 4. DEFINITIONS.

As used in this Act, unless the context otherwise requires, the term—

(1) "Office" means the Office of Industrial Technology established under section 5 of this Act.

(2) "Secretary" means the Secretary of Commerce.

(3) "Director" means the Director of the Office of Industrial Technology, appointed pursuant to section 5 of this Act.

(4) "Centers" means the Centers for Industrial Technology established under section 6 or section 8 of this Act.

(5) "Nonprofit institution" means an organization owned and operated exclusively for scientific or educational purposes, no part of the net earnings of which inures to the benefit of any private shareholder or individual.

(6) "Board" means the National Industrial Technology Board established pursuant to section 10.

(7) "Federal laboratory" means any laboratory, any federally funded research and development center, or any center established under section 6 or section 8 of this Act that is owned and funded by the Federal Government, whether operated by the Government or by a contractor.

(8) "Supporting agency" means either the Department of Commerce or the National Science Foundation, as appropriate.

Office of Industrial Technology, establishment. 15 USC 3704.

SEC. 5. COMMERCE AND TECHNOLOGICAL INNOVATION.

(a) In General.—The Secretary shall establish and maintain an Office of Industrial Technology in accordance with the provisions, findings, and purposes of this Act.

(b) Director.—The President shall appoint, by and with the advice and consent of the Senate, a Director of the Office, who shall be compensated at the rate provided for level V of the Executive Schedule in section 5316 of title 5, United States Code.

(c) Duties.—The Secretary, through the Director, on a continuing basis, shall—

(1) determine the relationships of technological developments and international technology transfers to the output, employment, productivity, and world trade performance of United States and foreign industrial sectors;

(2) determine the influence of economic, labor and other conditions, industrial structure and management, and government policies on technological developments in particular industrial sectors worldwide;

(3) identify technological needs, problems, and opportunities within and across industrial sectors that, if addressed, could make a significant contribution to the economy of the United States;

(4) assess whether the capital, technical and other resources being allocated to domestic industrial sectors which are likely to generate new technologies are adequate to meet private and social demands for goods and services and to promote productivity and economic growth;

(5) propose and support studies and policy experiments, in cooperation with other Federal agencies, to determine the effectiveness of measures with the potential of advancing United States technological innovation;

(6) provide that cooperative efforts to stimulate industrial innovation be undertaken between the Director and other officials in the Department of Commerce responsible for such areas as trade and economic assistance;

(7) consider government measures with the potential of advancing United States technological innovation and exploiting innovations of foreign origin; and

(8) publish the results of studies and policy experiments.

Report to President and Congress.

(d) Report.—The Secretary shall prepare and submit to the President and Congress, within 3 years after the date of enactment of this Act, a report on the progress, findings, and conclusions of activities conducted pursuant to sections 5, 6, 8, 11, 12, and 13 of this Act and recommendations for possible modifications thereof.

SEC. 6. CENTERS FOR INDUSTRIAL TECHNOLOGY.

15 USC 3705.

(a) Establishment.—The Secretary shall provide assistance for the establishment of Centers for Industrial Technology. Such Centers shall be affiliated with any university, or other nonprofit institution, or group thereof, that applies for and is awarded a grant or enters into a cooperative agreement under this section. The objective of the Centers is to enhance technological innovation through—

(1) the participation of individuals from industry and universities in cooperative technological innovation activities;

(2) the development of the generic research base, important for technological advance and innovative activity, in which individual firms have little incentive to invest, but which may have significant economic or strategic importance, such as manufacturing technology;

(3) the education and training of individuals in the technological innovation process;

(4) the improvement of mechanisms for the dissemination of scientific, engineering, and technical information among universities and industry;

(5) the utilization of the capability and expertise, where appropriate, that exists in Federal laboratories; and

(6) the development of continuing financial support from other mission agencies, from State and local government, and from industry and universities through, among other means, fees, licenses, and royalties.

(b) ACTIVITIES.—The activities of the Centers shall include, but need not be limited to—

(1) research supportive of technological and industrial innovation including cooperative industry-university basic and applied research;

(2) assistance to individuals and small businesses in the generation, evaluation and development of technological ideas supportive of industrial innovation and new business ventures;

(3) technical assistance and advisory services to industry, particularly small businesses; and

(4) curriculum development, training, and instruction in invention, entrepreneurship, and industrial innovation.

Each Center need not undertake all of the activities under this subsection.

(c) REQUIREMENTS.—Prior to establishing a Center, the Secretary shall find that—

(1) consideration has been given to the potential contribution of the activities proposed under the Center to productivity, employment, and economic competitiveness of the United States;

(2) a high likelihood exists of continuing participation, advice, financial support, and other contributions from the private sector;

(3) the host university or other nonprofit institution has a plan for the management and evaluation of the activities proposed within the particular Center, including:

(A) the agreement between the parties as to the allocation of patent rights on a nonexclusive, partially exclusive, or exclusive license basis to and inventions conceived or made under the auspices of the Center; and

(B) the consideration of means to place the Center, to the maximum extent feasible, on a self-sustaining basis;

(4) suitable consideration has been given to the university's or other nonprofit institution's capabilities and geographical location; and

(5) consideration has been given to any effects upon competition of the activities proposed under the Center.

(d) PLANNING GRANTS.—The Secretary is authorized to make available nonrenewable planning grants to universities or nonprofit institutions for the purpose of developing a plan required under subsection (c)(3).

Inventions, title acquisition.

(e) RESEARCH AND DEVELOPMENT UTILIZATION.—(1) To promote technological innovation and commercialization of research and development efforts, each Center has the option of acquiring title to any invention conceived or made under the auspices of the Center that was supported at least in part by Federal funds: *Provided*, That—

(A) the Center reports the invention to the supporting agency together with a list of each country in which the Center elects to file a patent application on the invention;

(B) said option shall be exercised at the time of disclosure of invention or within such time thereafter as may be provided in the grant or cooperative agreement;

(C) the Center intends to promote the commercialization of the invention and file a United States patent application;

(D) royalties be used for compensation of the inventor or for educational or research activities of the Center;

(E) the Center make periodic reports to the supporting agency, and the supporting agency may treat information contained in such reports as privileged and confidential technical, commercial, and financial information and not subject to disclosures under the Freedom of Information Act; and

(F) any Federal department or agency shall have the royalty-free right to practice, or have practiced on its behalf, the invention for governmental purposes.

The supporting agency shall have the right to acquire title to any patent on an invention in any country in which the Center elects not to file a patent application or fails to file within a reasonable time.

Supporting agency licensing rights.

(2) Where a Center has retained title to an invention under paragraph (1) of this subsection the supporting agency shall have the right to require the Center or its licensee to grant a nonexclusive, partially exclusive, or exclusive license to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, if the supporting agency determines, after public notice and opportunity for hearing, that such action is necessary—

(A) because the Center or licensee has not taken and is not expected to take timely and effective action to achieve practical application of the invention;

(B) to meet health, safety, environmental, or national security needs which are not reasonably satisfied by the contractor or licensee; or

(C) because the granting of exclusive rights in the invention has tended substantially to lessen competition or to result in undue market concentration in the United States in any line of commerce to which the technology relates.

U.S. Courts of Claims, petition.

(3) Any individual, partnership, corporation, association, institution, or other entity adversely affected by a supporting agency determination made under paragraph (2) of this subsection may, at any time within 60 days after the determination is issued, file a petition to the United States Court of Claims which shall have jurisdiction to determine that matter de novo and to affirm, reverse, or modify as appropriate, the determination of the supporting agency.

Antitrust laws.

(f) ADDITIONAL CONSIDERATION.—The supporting agency may request the Attorney General's opinion whether the proposed joint research activities of a Center would violate any of the antitrust laws. The Attorney General shall advise the supporting agency of his determination and the reasons for it within 120 days after receipt of such request.

SEC. 7. GRANTS AND COOPERATIVE AGREEMENTS.

15 USC 3706.

(a) IN GENERAL.—The Secretary may make grants and enter into cooperative agreements according to the provisions of this section in order to assist any activity consistent with this Act, including activities performed by individuals. The total amount of any such grant or cooperative agreement may not exceed 75 percent of the total cost of the program.

(b) ELIGIBILITY AND PROCEDURE.—Any person or institution may apply to the Secretary for a grant or cooperative agreement available under this section. Application shall be made in such form and manner, and with such content and other submissions, as the Director shall prescribe. The Secretary shall act upon each such application within 90 days after the date on which all required information is received.

(c) Terms and Conditions.—

(1) Any grant made, or cooperative agreement entered into, under this section shall be subject to the limitations and provisions set forth in paragraph (2) of this subsection, and to such other terms, conditions, and requirements as the Secretary deems necessary or appropriate.

(2) Any person ,who receives or utilizes any proceeds of any grant made or cooperative agreement entered into under this section shall keep such records as the Secretary shall by regulation prescribe as being necessary and appropriate to facilitate effective audit and evaluation, including records which fully disclose the amount and disposition by such recipient of such proceeds, the total cost of the program or project in connection with which such proceeds were used, and the amount, if any, of such costs which was provided through other sources.

15 USC 3707.

SEC. 8. NATIONAL SCIENCE FOUNDATION CENTERS FOR INDUSTRIAL TECHNOLOGY.

(a) Establishment and Provisions.—The National Science Foundation shall provide assistance for the establishment of Centers for Industrial Technology. Such Centers shall be affiliated with a university, or other nonprofit institution, or a group thereof. The objective of the Centers is to enhance technological innovation as provided in section 6(a) through the conduct of activities as provided in section 6(b). The provisions of sections 6(e) and 6(f) shall apply to Centers established under this section.

(b) Planning Grants.—The National Science Foundation is authorized to make available nonrenewable planning grants to universities or nonprofit institutions for the purpose of developing the plan, as described under section 6(c)(3).

(c) Terms and Conditions.—Grants, contracts, and cooperative agreements entered into by the National Science Foundation in execution of the powers and duties of the National Science Foundation under this Act shall be governed by the National Science Foundation Act of 1950 and other pertinent Acts. 42 USC 1861 note.

15 USC 3708.

SEC. 9. ADMINISTRATIVE ARRANGEMENTS.

(a) Coordination.—The Secretary and the National Science Foundation shall, on a continuing basis, obtain the advice and cooperation of departments and agencies whose missions contribute to or are affected by the programs established under this Act, including the development of an agenda for research and policy experimentation. These departments and agencies shall include but not be limited to the Departments of Defense, Energy, Education, Health and Human Services, Housing and Urban Development, the Environmental Protection Agency, National Aeronautics and Space Administration, Small Business Administration, Council of Economic Advisers, Council on Environmental Quality, and Office of Science and Technology Policy.

(b) Cooperation.—It is the sense of the Congress that departments and agencies, including the Federal laboratories, whose missions are affected by, or could contribute to, the programs established under this Act, should, within the limits of budgetary authorizations and appropriations, support or participate in activities or projects authorized by this Act.

(c) ADMINISTRATIVE AUTHORIZATION.—

(1) Departments and agencies described in subsection (b) are authorized to participate in, contribute to, and serve as resources for the Centers and for any other activities authorized under this Act.

(2) The Secretary and the National Science Foundation are authorized to receive moneys and to receive other forms of assistance from other departments or agencies to support activities of the Centers and any other activities authorized under this Act.

(d) COOPERATIVE EFFORTS.—The Secretary and the National Science Foundation shall, on a continuing basis, provide each other the opportunity to comment on any proposed program of activity under section 6, 8, or 13 of this Act before funds are committed to such program in order to mount complementary efforts and avoid duplication.

SEC. 10. NATIONAL INDUSTRIAL TECHNOLOGY BOARD.

15 USC 3709.

(a) ESTABLISHMENT.—There shall be established a committee to be known as the National Industrial Technology Board.

(b) DUTIES.—The Board shall take such steps as may be necessary to review annually the activities of the Office and advise the Secretary and the Director with respect to—

(1) the formulation and conduct of activities under section 5 of this title;

(2) the designation and operation of Centers and their programs under section 6 of this Act including assistance in establishing priorities;

(3) the preparation of the report required under section 5(d); and

(4) such other matters as the Secretary or Director refers to the Board, including the establishment of Centers under section 8 of this Act, for review and advice.

The Director shall make available to the Board such information, personnel, and administrative services and assistance as it may reasonably require to carry out its duties. The National Science Foundation shall make available to the Board such information and assistance as it may reasonably require to carry out its duties.

(c) MEMBERSHIP, TERMS, AND POWERS.—

(1) The Board shall consist of 15 voting members who shall be appointed by the Secretary. The Director shall serve as a nonvoting member of the Board. The members of the Board shall be individuals who, by reason of knowledge, experience, or training are especially qualified in one or more of the disciplines and fields dealing with technology, labor, and industrial innovation or who are affected by technological innovation. The majority of the members of the Board shall be individuals from industry and business.

(2) The term of office of a voting member of the Board shall be 3 years, except that of the original appointees, five shall be appointed for a term of 1 year, five shall be appointed for a term of 2 years, and five shall be appointed for a term of 3 years.

(3) Any individual appointed to fill a vacancy occurring before the expiration of the term for which his or her predecessor was appointed shall be appointed only for the remainder of such term. No individual may be appointed as a voting member after serving more than two full terms as such a member.

(4) The Board shall select a voting member to serve as the Chairperson and another voting member to serve as the Vice Chairperson. The Vice Chairperson shall perform the functions of the Chairperson in the absence or incapacity of the Chairperson.

45 FR 69201.

(5) Voting members of the Board may receive compensation at a daily rate for GS-18 of the General Schedule under section 5332 of title 5, United States Code, when actually engaged in the performance of duties for such Board, and may be reimbursed for actual and reasonable expenses incurred in the performance of such duties.

15 USC 3710.

SEC. 11. UTILIZATION OF FEDERAL TECHNOLOGY.

Technology transfer.

(a) Policy.—It is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal investment in research and development. To this end the Federal Government shall strive where appropriate to transfer federally owned or originated technology to State and local governments and to the private sector.

(b) Establishment of Research and Technology Applications Offices.—Each Federal laboratory shall establish an Office of Research and Technology Applications. Laboratories having existing organizational structures which perform the functions of this section may elect to combine the Office of Research and Technology Applications within the existing organization. The staffing and funding levels for these offices shall be determined between each Federal laboratory and the Federal agency operating or directing the laboratory, except that (1) each laboratory having a total annual budget exceeding $20,000,000 shall provide at least one professional individual full-time as staff for its Office of Research and Technology Applications, and (2) after September 30, 1981, each Federal agency which operates or directs one or more Federal laboratories shall make available not less than 0.5 percent of the agency's research and development budget to support the technology transfer function at the agency and at its laboratories, including support of the Offices of Research and Technology Applications. The agency head may waive the requirements set forth in (1) and/or (2) of this subsection. If the agency head waives either requirement (1) or (2), the agency head shall submit to Congress at the time the President submits the budget to Congress an explanation of the reasons for the waiver and alternate plans for conducting the technology transfer function at the agency.

Waiver.
Submittal to Congress.

(c) Functions of Research and Technology Applications Offices.—It shall be the function of each Office of Research and Technology Applications—

(1) to prepare an application assessment of each research and development project in which that laboratory is engaged which has potential for successful application in State or local government or in private industry;

(2) to provide and disseminate information on federally owned or originated products, processes, and services having potential application to State and local governments and to private industry;

(3) to cooperate with and assist the Center for the Utilization of Federal Technology and other organizations which link the research and development resources of that laboratory and the Federal Government as a whole to potential users in State and local government and private industry; and

(4) to provide technical assistance in response to requests from State and local government officials.

Agencies which have established organizational structures outside their Federal laboratories which have as their principal purpose the transfer of federally owned or originated technology to State and local government and to the private sector may elect to perform the functions of this subsection in such organizational structures. No Office of Research and Technology Applications or other organizational structures performing the functions of this subsection shall substantially compete with similar services available in the private sector.

Establishment.

(d) CENTER FOR THE UTILIZATION OF FEDERAL TECHNOLOGY.—There is hereby established in the Department of Commerce a Center for the Utilization of Federal Technology. The Center for the Utilization of Federal Technology shall—

(1) serve as a central clearinghouse for the collection, dissemination and transfer of information on federally owned or originated technologies having potential application to State and local governments and to private industry;

(2) coordinate the activities of the Offices of Research and Technology Applications of the Federal laboratories;

(3) utilize the expertise and services of the National Science Foundation and the existing Federal Laboratory Consortium for Technology Transfer; particularly in dealing with State and local governments;

(4) receive requests for technical assistance from State and local governments and refer these requests to the appropriate Federal laboratories;

(5) provide funding, at the discretion of the Secretary, for Federal laboratories to provide the assistance specified in subsection (c)(4); and

(6) use appropriate technology transfer mechanisms such as personnel exchanges and computer-based systems.

(e) AGENCY REPORTING.—Each Federal agency which operates or directs one or more Federal laboratories shall prepare biennially a report summarizing the activities performed by that agency and its Federal laboratories pursuant to the provisions of this section. The report shall be transmitted to the Center for the Utilization of Federal Technology by November 1 of each year in which it is due.

SEC. 12. NATIONAL TECHNOLOGY MEDAL.

15 USC 3711.

(a) ESTABLISHMENT.—There is hereby established a National Technology Medal, which shall be of such design and materials and bear such inscriptions as the President, on the basis of recommendations submitted by the Office of Science and Technology Policy, may prescribe.

(b) AWARD.—The President shall periodically award the medal, on the basis of recommendations received from the Secretary or on the basis of such other information and evidence as he deems appropriate, to individuals or companies, which in his judgment are deserving of special recognition by reason of their outstanding contributions to the promotion of technology or technological manpower for the improvement of the economic, environmental, or social well-being of the United States.

(c) PRESENTATION.—The presentation of the award shall be made by the President with such ceremonies as he may deem proper.

15 USC 3712.

SEC. 13. PERSONNEL EXCHANGES.

The Secretary and the National Science Foundation, jointly, shall establish a program to foster the exchange of scientific and technical personnel among academia, industry, and Federal laboratories. Such program shall include both (1) federally supported exchanges and (2) efforts to stimulate exchanges without Federal funding.

15 USC 3713.

SEC. 14. AUTHORIZATION OF APPROPRIATIONS.

(a) There is authorized to be appropriated to the Secretary for purposes of carrying out section 6, not to exceed $19,000,000 for the fiscal year ending September 30, 1981, $40,000,000 for the fiscal year ending September 30, 1982, $50,000,000 for the fiscal year ending September 30, 1983, and $60,000,000 for each of the fiscal years ending September 30, 1984, and 1985.

(b) In addition to authorizations of appropriations under subsection (a), there is authorized to be appropriated to the Secretary for purposes of carrying out the provisions of this Act, not to exceed $5,000,000 for the fiscal year ending September 30, 1981, $9,000,000 for the fiscal year ending September 30, 1982, and $14,000,000 for each of the fiscal years ending September 30, 1983, 1984, and 1985.

(c) Such sums as may be appropriated under subsections (a) and (b) shall remain available until expended.

(d) To enable the National Science Foundation to carry out its powers and duties under this Act only such sums may be appropriated as the Congress may authorize by law.

15 USC 3714.

SEC. 15. SPENDING AUTHORITY.

No payments shall be made or contracts shall be entered into pursuant to this Act except to such extent or in such amounts as are provided in advance in appropriation Acts.

Approved October 21, 1980.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 96-1199 (Comm. on Science and Technology).
SENATE REPORT No. 96-781 (Comm. on Commerce, Science, and Transportation).
CONGRESSIONAL RECORD, Vol. 126 (1980):
 May 28, considered and passed Senate.
 Sept. 8, considered and passed House, amended.
 Sept. 26, Senate concurred in certain House amendments, disagreed to others, and concurred in remainder with amendments.
 Oct. 1, House receded from its amendments and concurred in Senate amendments.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 16, No. 43:
 Oct. 21, Presidential statement.

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Mr. **Walgren**. I'd like to recognize my colleague Mr. Brown, for any opening statements and observations he would like to make.

Mr **Brown**. Mr. Chairman, I have no opening statement. But I am looking forward to these hearings, as part of the process of helping throw light on the focus of this administration to do what I think they recognize, as well as everyone else, as one of the most important problems facing the country: How to reestablish the competitive position of American business and industry in the global marketplace.

I don't think there is any divine wisdom represented in the approaches that have been taken before to solve this problem, but obviously we do need to address it vigorously. And I am hoping that this administration will be able to indicate how, if it is not due to mechanisms such as are included in the Stevenson-Wydler Act, we can approach this problem and accomplish successfully the full utilization of our scientific and technological research, for the benefit of our country.

Mr. **Walgren**. Thank you, Mr. Brown.

I understand we have an opening statement from Mrs. Margaret Heckler, ranking minority member. She will probably be here soon, and she may want to make a statement at that point. Otherwise, it will be entered into the record at this point.

[The opening statement of Mrs. Heckler follows:]

OPENING REMARKS BY
HONORABLE MARGARET M. HECKLER
OVERSIGHT HEARINGS ON
STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT
JULY 14, 1981

THANK YOU MR. CHAIRMAN.

I WOULD LIKE TO THANK THE EXCEPTIONALLY DISTINGUISHED AND WELL QUALIFIED GROUP OF WITNESSES WITH US HERE TODAY. THE VITAL ROLE OF TECHNOLOGY IN INNOVATION AND PRODUCTIVITY IS EVIDENCED BY THE APPEARANCE OF DEPUTY SECRETARY OF COMMERCE, MR. WRIGHT, ALONG WITH DR. AMBLER, DIRECTOR OF THE NATIONAL BUREAU OF STANDARDS AND MR. DAY, DIRECTOR OF THE NATIONAL TECHNICAL INFORMATION SERVICE.

IT IS A GREAT HONOR TO HAVE SENATOR HARRISON SCHMITT WITH US HERE TODAY. SENATOR, IT IS TO YOUR HONOR THAT YOU HAVE PURSUED THIS ISSUE WITH SUCH SKILL AND DILIGENCE.

I LOOK FORWARD TO THE TESTIMONY OF THE INDUSTRY PANEL, SINCE THIS IS WHERE I FEEL THE MOST WORK CAN BE ACCOMPLISHED TOWARD INCREASING INNOVATION AND PRODUCTIVITY. THE FEDERAL GOVERNMENT SHOULD ONLY PROVIDE THOSE SERVICES THAT ARE ABSOLUTELY ESSENTIAL TO ENSURE ECONOMIC VITALITY.

I DO FEEL THAT MUCH OF THE GOVERNMENT SPONSORED RESEARCH AND DEVELOPMENT ACTIVITY IS WASTED -- SIMPLY BECAUSE THE GOVERNMENT IS PAYING FOR R&D ACTIVITIES DOES NOT GUARANTEE THAT INDUSTRY OR SOCIETY AS A WHOLE WILL BENEFIT.

RESEARCH AND DEVELOPMENT ARE INTEGRAL PARTS OF THE INNOVATION PROCESS, BUT THEY MAKE NO ECONOMIC CONTRIBUTION UNLESS THE KNOWLEDGE IS INTEGRATED INTO THE PRODUCTION PROCESS OR MANIFESTED IN A NEW OR IMPROVED PRODUCT THAT IS SOLD ON THE MARKET.

THE TECHNOLOGIES GAINED THROUGH R&D MUST BE "TRANSFERRED", IN EFFECT, TO INDUSTRY AND OTHER SECTORS OF THE ECONOMY THAT CAN BRING THE NEW INNOVATIONS TO THE MARKET PLACE SO ALL AMERICANS CAN SHARE IN THE BENEFIT. IF THE FEDERAL GOVERNMENT IS NOT DOING A GOOD JOB OF SUCH "TECHNOLOGY TRANSFER" THEN MUCH OF THE VALUE OF THE R&D IT SPONSORS IS WASTED. IN ORDER TO AVOID CONTINUED UNDER-UTILIZATION OF FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT RECEIVED BIPARTISAN SUPPORT IN THE 96TH CONGRESS.

THE ACT HAS A POTENTIALLY IMPORTANT ROLE TO PLAY IN THE SUPPORT OF INCREASED INNOVATION AND PRODUCTIVITY. MUCH OF THE ACT'S SUCCESS WILL DEPEND ON HOW WELL IT IS IMPLEMENTED BY THE DEPARTMENT OF COMMERCE AND THE NATIONAL SCIENCE FOUNDATION, ALONG WITH HOW MUCH SUPPORT THESE AGENCIES RECEIVE FROM INDUSTRY.

SUCH IS THE PURPOSE OF THESE HEARINGS. THE DEPARTMENT OF COMMERCE HAS A GREAT OPPORTUNITY HERE. IMPLEMENTATION OF THE ACT WITH ALACRITY AND DILIGENCE WOULD PROVIDE A SIGNIFICANT BOOST TO INDUSTRY, ESPECIALLY SMALL BUSINESSES.

THANK YOU MR. CHAIRMAN.

Mr. **Walgren**. We have three panels today. The first is led by Joseph Wright, the Deputy Secretary of Commerce. Mr. Wright is accompanied by Dr. Ernest Ambler, Director of the National Bureau of Standards; and Melvin Day, the Director of the National Technical Information Service.

We welcome you to the committee and I would just say at the outset that any written statement that you would like to submit will be, of course, entered into the record in full. Please feel free to proceed and summarize or communicate your thoughts, as best you feel.

[The biographical sketch of Mr. Wright follows:]

BIOGRAPHY
JOSEPH R. WRIGHT, JR.
DEPUTY SECRETARY OF COMMERCE

Joseph R. Wright, Jr., was nominated by President Ronald Reagan to serve as Deputy Secretary of Commerce on January 29, 1981. He was confirmed by the United States Senate on April 8.

An experienced businessman and public servant, Mr. Wright has worked extensively in the Federal government and private industry.

Mr. Wright had been President of Retail Consumer Services, Inc., a wholly-owned subsidiary of Citicorp. In this capacity he was responsible for the management of 27 offices with 2,000 employees and $1.4 billion in customer sales.

Prior to joining Citicorp in 1976, Mr. Wright served as Assistant Secretary of Administration, U.S. Department of Agriculture. He has also held the positions of Deputy Director of the Social and Economic Statistics Administration and Deputy Director of the Bureau of the Census, U.S. Department of Commerce.

From 1966 to 1971, Mr. Wright was Vice President and Division Head of Booz, Allen and Hamilton, Inc., where he was responsible for new products and marketing.

Mr. Wright, 42, received a Bachelor of Science degree from the Colorado School of Mines and graduated with a Master's in Business Administration from Yale University in 1964.

He was born in Tulsa, Oklahoma.

May 1981

TESTIMONY OF JOSEPH R. WRIGHT, JR., DEPUTY SECRETARY OF COMMERCE; DR. ERNEST AMBLER, DIRECTOR, NATIONAL BUREAU OF STANDARDS; AND MELVIN DAY, DIRECTOR, NATIONAL TECHNICAL INFORMATION SERVICE

Mr. **Wright**. Thank you, Mr. Chairman.

We are pleased to be here this morning, to testify on the implementation of the Stevenson-Wydler Technology Innovation Act of 1980. We will submit written testimony for the record, and I would like to briefly highlight some of the major points.

To begin with, there probably isn't a time for a greater need of attention and focus on technology and productivity growth. During a 20-year period, from 1948 to 1968, our productivity in the United States grew 3.1 percent. For the next 8 years after that, it dropped to 2.2 percent. Then, in the last 7 years, it dropped to 0.6 percent annually.

When compared to the major trading nations that we compete with overseas, in the late 1960's and early 1970's, we grew half as fast in productivity as they did; and in the late 1970's, we grew one-third as fast.

Mr. Chairman, we cannot afford to continue that trend, and if we do not reverse it, the rate of increase in real wages and in our standard of living will be low, our competitiveness in foreign and domestic markets will continue to erode, and our ability to respond to our new national needs will be reduced.

The factors which determine productivity are complex, and I won't go through them at this time. But the Stevenson-Wydler Act focuses on one of the more important of these factors, which is technological innovation.

In past years, we have not had as intense a foreign competition as exists today. We do expect it to increase. The trade deficits that we have been faced with over the past 6 years will probably increase. But more important, our share of world exports of manufactured goods declined from 25 percent to only 18 percent in the last 20 years. We exported approximately 8.5 percent of our gross national product, and this is compared to 17 percent for Japan, and over 20 percent for both West Germany and France.

Technological innovation is essential if we are to overcome these problems. Unfortunately, it is perhaps the most difficult determinant of productivity to understand.

The factors that influence the private sector to invest in technological innovation are similar, we feel, to those which influence normal investment decisions. These would include the market outlook, the cost of funds, taxes, regulations, and, in other words, an overall favorable economic climate. We feel that it is a prime determinant.

The President's economic recovery program should encourage the marketplace to provide the funds for industry to undertake needed innovations, particularly new tax credits for incremental research and development. However, there is a proper role for Federal agencies, such as the Department of Commerce, in this process.

We feel that it has less to do with Federal selection of specific types of commercial technologies for development, and more to do with making sure that we are collecting the right type of pertinent data, and properly assessing, analyzing, and communicating it to the private sector.

As Secretary Baldrige indicated in his appearance before this subcommittee last June 16, in the Department of Commerce are planning to consolidate our economic and policy development activities into a single organization, reporting to, as proposed, an Under Secretary for Economic Affairs. We believe that macroeconomic policymaking needs to be strengthened by a greater understanding of the factors that influence sectoral or business-by-business economic performance, and we particularly believe that the role of technology has got to be better analyzed and understood in understanding sectoral performance.

The economic and technology issues are linked closely, and must be dealt with at the same time. Two important new programs will be designed within the Department of Commerce to enhance the productivity and competitiveness of U.S. industry. There will be a competitive assessments program and a productivity and technology program.

In the area of productivity and technology, short-term influences will be separated from long-run influences. Changes in relative costs of capital, materials, and labor will be evaluated. Productivity information needs will be identified, foreign and domestic productivity information will be collected, cataloged and assessed; and then this information will be disseminated to the private sector.

We will examine the contribution of such factors to industry performance as technological development, industrial structure, and the capital intensity of production.

We feel, Mr. Chairman, that at the Department of Commerce we generate most of the economic information in the United States on a business-by-business basis, but we simply haven't carried our analysis far enough to be of use to the private sector in the productivity and technology areas. We intend to correct that. These efforts will be closely coordinated with the National Bureau of Standards, the National Technical Information Service, and the Patent and Trademark Office, which are the technology arms of the Department.

We will coordinate with the International Trade Administration, to take advantage of international coordination activities. We will be coordinating with the Office of General Counsel for regulatory policy—or, as it is now called, deregulatory policy—and with the Office of Business Liaison for relationships with business and with industry.

We believe that this approach is consistent, and actually enhances our ability to deliver on the intent of section 5. Unfortunately, other provisions of the Stevenson-Wydler Act are not as easily adapted or improved upon.

Section 6 authorizes a program of Federal financial assistance to support joint university/industry centers for industrial technology. We feel that this runs counter to the spirit of the economic program of reduced Federal expenditures. However, we also believe that by lowering the Federal tax burden and by providing special tax incentives, the private sector, on its own, should and will establish and support needed industry/university cooperative research centers.

We see this, again, taking place at several universities already. However, we do have an ongoing cooperative research program at the National Bureau of Standards, whereby industries and universities send employees to us, to work on projects of mutual benefit. $1.7 million has been maintained in the National Science Foundation's budget to support centers of this type.

Now, the section 11 provisions on technology transfer we wholeheartedly endorse, to the extent that they can be implemented.

Let's go first to section 11(b), which requires each and every Federal laboratory, including the 45 or so in the Department of Commerce, to designate an office of research and technological applications, to provide and disseminate information. The National Bureau of Standards has already fully complied, and I have directed our other labs within the Department of Commerce to complete the process of designating their offices as quickly as possible.

It is also required that agencies having Federal laboratories spend at least 0.5 percent of their R. &. D. budget on technology transfer. I believe, Mr. Chairman, that all agencies within the Department of Commerce, which have laboratories, presently expend at least this amount on technology transfer.

On the other hand, we do not have the resources to establish a center for the utilization of Federal technology, as mentioned in section 11(b) of the act, but NTIS will collect, publish, and actively market an assessment on every research and development project in these Federal laboratories, as they are able to obtain the information, and as required by section 11(c) of the Stevenson-Wydler Act.

NTIS is currently working with the Federal Laboratory Consortium on the collection and dissemination of these assessments.

Expanding the existing NTIS "technical notes" program is another planned technology transfer initiative which we feel is important, and which widely distributes summaries of new applications for technology developed by Federal agencies and their contractors. And so, we believe that we do have an active program in this area, Mr. Chairman, and are looking toward it as an important part of the act.

The remaining portions of the Stevenson-Wydler Act that pertain to the Department of Commerce deal with the establishment of a National Industrial Technology Board; recommendations by the Secretary of recipients for a Presidentially awarded national technology medal; and the establishment of a joint NSF/Department of Commerce program to foster the exchange of scientific and technical personnel.

We will be in a better position to respond to these provisions after our reorganization is operational, and we have a better feeling in terms of what the ability of the Department to respond is.

I just want to conclude by assuring the subcommittee that we share your concerns, and want to work with you on achieving our mutual goal of helping American business increase its technological innovations and its productivity. We consider that to be one of the most important jobs we have in the Department of Commerce, Mr. Chairman.

Thank you.

[The prepared statement of Mr. Wright follows:]

STATEMENT OF

JOSEPH R. WRIGHT, JR.

DEPUTY SECRETARY OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

JULY 14, 1981

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss the Department's implementation of the Stevenson-Wydler Technology Innovation Act of 1980. On behalf of Secretary Baldrige and the staff of the Department, I want to commend the Subcommittee for its longstanding record of concern for the state of technological innovation in the United States and for its recognition of the vital link between technological innovation and productivity.

At no time since the end of the Second World War has there been a greater need to focus the Nation's attention on productivity growth. From a 3.1 percent average annual rate of productivity increase for private business in the 1948-1968 period, we have steadily declined to average annual gains of 2.2 percent in the 1968-1973 period and only 0.6 percent in the 1973-1980 period. With respect to this last period, we actually experienced declines of 0.2, 0.4, and 0.3 percent in 1978, 1979 and 1980, respectively. Another way of look at it would be the gross domestic product per employee, where we experienced a growth rate of only 0.3 percent in the period 1973-1980; comparable figures for Japan and West Germany were 3.5 and 2.9 percent, respectively.

If we do not reverse this trend, the rate of increase in real wages and in our standard of living will be low, our competitiveness in foreign and domestic markets will erode, and our ability to respond to new national needs will be reduced. At the same time, the factors which determine productivity are complex and interrelated. Without attempting to be exhaustive, the figures I cited reflect a decrease in our rate of technological innovation, low levels of savings and investment, the influx of inexperienced workers into the labor force, shifts in the structure of the economy toward services and lower-productivity enterprises, and, most importantly, costly Federal regulations, a declining rate of return on capital investment, and increases in energy prices. All of these adversely affected the climate for investment in R&D and in the capital goods that embody new technology.

Stevenson-Wydler focuses on one of these factors: technological innovation -- the process by which industry develops and introduces new and improved products and processes. It is a critical factor now and it will continue to be so. In past years we did not have intense foreign competition to the degree that it exists today. We can expect foreign competition to increase in the coming years as Japan, Germany, France and newly industrializing countries shift their national industrial strategies toward creating, as well as borrowing, new technologies.

The effects of increasing foreign competition have already been felt. Since 1976 we have had a record string of trade deficits totaling over $100 billion. In addition, between 1960 and 1980 our share of world exports of manufactured goods declined from 25 percent to only 18 percent.

Technological innovation is essential if we are to overcome this. Unfortunately, it is perhaps the most difficult determinant of productivity to understand. As the Congressional Budget Office noted in its January, 1981 study on "The Productivity Problem: Alternatives for Action", there is currently no direct measure of innovation that is meaningful; there are only indirect measures such as R&D spending or the number of patents awarded. In addition, investment in and use of new technologies are often inhibited by such intangibles as the pressure on many managers and investors to concentrate on short-term earnings performance.

What does seem clear, however, is that the factors that influence the private sector to invest in technological innovation are similar to those which influence other investment decisions. The most vital factor is the perception of risks and expected return from innovative effort relative to other opportunities. This in turn depends on the market outlook, the cost of funds, taxes and regulations -- in other words, a favorable economic climate.

We are now proposing to implement a comprehensive Presidential program to reverse the adverse trends in productivity and technology innovation by restoring an economic environment in which there can be real and substantial returns for working, saving and investing. This, of course, includes a policy of reduced Federal expenditures; a program of regulatory reform; a stable monetary policy that encourages long-term planning and investment; a tax policy that provides incentives for modernizing our industrial/manufacturing base, expands research and development and increases the incentives to save and invest. The President's program should encourage the market place to provide the funds for industry to undertake needed innovations.

Although the President's Program reflects the principle that technological innovation and productivity improvement are responsibilities of the private sector and that this will occur if the economic climate is favorable, this does not mean that there is not a necessary and proper role for Federal agencies such as the Department of Commerce. We believe that this role has less to do with Federal selection of specific types of commercial technologies for development and more to do with making sure that we are collecting the right type of pertinent data and properly assessing, analyzing and communicating it to the private sector. Only then can we understand the nature of the complex problems associated with technological innovation - problems that may vary from industry to industry - and formulate appropriate policy recommendations. Stevenson-Wydler, particularly Section 5(c), also recognizes the importance of such analyses.

As the Secretary indicated in his appearance before this Subcommittee on June 16, we are planning to reorganize the Department's economic and policy development activities to make better use of the Department's data-gathering and analytical resources. In the past, these functions were fragmented, making coordination of resources difficult, and complicating our efforts to assist the private sector improve industrial competitiveness and productivity. This reorganization will enable the Department to provide better service to our business community, to do so more efficiently, and, most importantly, enable us to make a greater contribution to the development of national economic policy within the Executive branch and direct our technology programs and data-gathering to the area of greatest need and payoff. We have communicated our priority in this area by proposing an upgrade of the senior executive position in this area to Under Secretary for Economic Affairs. The Secretary has sent Administration-supported draft legislation to the Congress to authorize that position.

Although some of the details of our reorganization proposal are still being developed, its basic outline reflects our belief that macroeconomic policymaking needs to be strengthened by a greater understanding of the factors that influence sectoral economic performance and particularly of the role technology plays in sectoral performance. At this time there is no doubt that economic and technology issues are inextricably linked and must be dealt with at the same time. To accomplish this, I anticipate that, among the others reporting to the Under Secretary, there will be an Assistant Secretary who would administer two important new programs designed to enhance the productivity and competitiveness of U. S. industry -- a competitive assessment program and a productivity and technology program. The functions specified in Section 5(c) of Stevenson-Wydler are necessary parts of these two programs and we believe this Assistant Secretary and the units under that position are the best place for those functions to be performed.

In the area of competitive assessment, the Assistant Secretary will perform comprehensive analyses of critical industries to identify and measure variables contributing to economic performance and the impact of government policies and other factors. Expected performance and alternative performances based on varying the identified factors will be projected. Extensive consultation will take place with business before policies are recommended and follow-through with business will take place as policy is implemented.

The competitive assessment program will improve Federal policy-making; enable business to assess its prospects, problems and policies more effectively; help Commerce redirect its data collection programs; and highlight needed regulatory reform.

In the area of productivity and technology, the Assistant Secretary and the units under that position will measure contributions to productivity of specific factors in individual industries. Short-term influences will be separated from long-run influences; the effect of changes in relative cost of capital, materials and labor will be evaluated; and problem industries as well as the nature and source of their problems will be identified. Business productivity information needs will be identified; foreign and domestic productivity information will be collected, catalogued and assessed; and information will be disseminated through clearinghouse, workshop, and other outreach activities.

In general terms, this reorganization will build on the substantial range of statistics that reflect and measure economic performance and market competitiveness and which are collected by the Census Bureau, the Bureau of Economic Analysis, and other components. This information gives us vital information on growth, price, employment and productivity trends, returns on labor and capital, exports and the like. These data will then be analyzed to examine the contribution of such factors to industry performance as technological development, industrial structure, and capital intensity of production. We will then examine how these factors are affected by spending, tax, monetary, regulatory and trade policies.

The Assistant Secretary will work closely with other related organizations within Commerce beyond those we normally think of as "economic." For technological developments and information the Assistant Secretary will work with the National Bureau of Standards, the National Technical Information Service, and the Patent and Trademark Office. The Assistant Secretary will draw upon the International Trade Administration for international economic information; the Office of General Counsel for regulatory policy and assistance in preparing and analyzing legislative initiatives; and the Office of Business Liaison in the Office of the Associate Deputy Secretary, for relationships with business and industry.

In short, our plans should enable the Assistant Secretary to make productivity and technology policy recommendations; analyze technology needs and opportunities; promote the reduction of barriers to private sector innovation; improve the transfer to the private sector and to State and local governments of technological information resulting from Federally-funded research; and better coordinate Commerce's technology and productivity programs.

We believe this approach is consistent with the intent of Section 5, even though the organizational structure differs.

Unfortunately, other provisions of Stevenson-Wydler are not as easily adapted.

Specifically, Section 6 of Stevenson-Wydler authorizes a program of Federal financial assistance through grants and cooperative agreements to support joint university/industry Centers for Industrial Technology which would focus on the development of generic technologies. As Secretary Baldrige testified earlier this year before the House Appropriations Subcommittee, the Centers program was a fine initiative but its emphasis on financial assistance runs counter to the spirit of the President's Economic Recovery Program. We are therefore pleased that Congress has approved the rescission of funds for it for FY 1981 and has honored our request that no funds be appropriated for it for FY 1982.

Let me stress, however, that this should not be taken as our disapproval of intent behind the Centers concept. We have ongoing cooperative research programs at the National Bureau of Standards whereby industries and universities send employees to us to work on projects of mutual benefit.

We feel that by lowering the Federal tax burden and by providing tax incentives, such as the Administration's proposed tax credit for incremental R&D, the private sector on its own will establish and support needed industry/university cooperative research ventures. We see this beginning to take place at several universities such as Cal Tech, Harvard, and Stanford. Within existing budgetary resources, we hope to play a role in bringing more universities and businesses together for similar projects.

Further, the Administration has not entirely abandoned the concept of Federal support for cooperative research centers. $1.7 million has been maintained in the National Science Foundation's budget to support centers and the Administration did not seek the repeal of Section 6 as part of its reconciliation package. Should a program along the lines of Section 6 prove necessary in later years, the legislation will be in place to conduct it.

The other major aspect of Stevenson-Wydler for the Department is the Section 11 provisions on technology transfer. We wholeheartedly endorse that section to the extent that it can be implemented -- and I believe large parts of it can -- without the expenditure of additional appropriated funds.

Section 11(b) requires each and every Federal laboratory, including the forty-five or so in the Department of Commerce, to designate an Office of Research and Technological Applications to provide and disseminate information on Federally-owned or originated products, processes and services having potential application to State and local governments and to private industry. The National Bureau of Standards has already fully complied with the Act's mandate by restructuring its extensive technology transfer activities. I have directed our other labs in the National Oceanic and Atmospheric Administration, the National Telecommunications and Information Administration, and the Maritime Administration to complete the process of designating their offices as quickly as possible.

That section also requires agencies having Federal laboratories to spend at least one-half of one percent of their R&D budget on technology transfer. I believe all agencies within Commerce which have laboratories presently expend at least this amount on technology transfer. We are in the process of confirming this and I have directed all such components to provide me with the most current data.

Section 11(d) of the Stevenson-Wydler Act establishes a Center for the Utilization of Federal Technology (CUFT) within Commerce with a number of assigned functions ranging from serving as an information clearinghouse to giving financial assistance to Federal laboratories to enable them to provide technical assistance to State and local governments upon their request. To the extent that specified CUFT functions require the outlay of appropriated funds, we will not be able to perform them. The Congress has approved the FY 1981 rescission of appropriations for CUFT and has honored the Administration's request that no funds be appropriated for it for FY 1982. As in Section 6, the increased Federal spending aspects of Section 11 are not consistent with the President's Economic Recovery Program.

This is not to say we think technology transfer is unimportant. The Administration's policy with respect to technology transfer is clear -- transfer as much information as quickly as possible when it is incidental to R&D work and can be done without direct appropriations. For technology transfer that is not incidental to R&D work and requires financing, we feel that the recipients should pay the transfer costs through user fees.

Section 11(c) of Stevenson-Wydler requires the Office of Research and Technology Applications in each Federal Laboratory to prepare an assessment of every research and development project at the laboratory having potential for industrial (or State or local government) application. NTIS will collect, publish, and actively market those assessments. NTIS is working with the Federal Laboratory Consortium to design a standardized assessment format and to establish procedures for the efficient collection and dissemination of assessments. Assessments will be made available through special publications; on-line data processing services; or other innovative techniques.

Expanding the existing NTIS "tech notes" program is another planned technology transfer initiative. This program, which widely distributes summaries of new applications for technology developed by Federal agencies and their contractors, would be greatly enlarged to assure coverage of all Federal laboratories willing to participate.

NTIS has already begun preparations to implement these two promising technology transfer activitives. As NTIS identifies additional activities with the potential to become self-supporting, it will consider adding them to its program of stimulating the utilization of Federal technology.

The remaining portions of the Act that pertain to the Department deal with the establishment of a National Industrial Technology Board (NTIB); recommendations by the Secretary of recipients for a Presidentially-awarded National Technology Medal; and the establishment of a joint NSF/DoC program to foster the exchange of scientific and technical personnel among academia, industry and Federal laboratories.

With respect to the NTIB, the Department has traditionally solicited the best advice available from outside sources in order to assist it in performing its many functions. The Commerce Technical Advisory Board (CTAB) for many years provided advice similar to that which the NTIB would provide. After our reorganization is completed we will consider how best to obtain outside advice of the type CTAB or NTIB would provide. It is conceivable that we will reactivate CTAB and/or establish an NTIB or some similar advisory committee. We will keep the Congress informed.

Likewise, when our reorganization is complete, we will be better equipped to make appropriate recommendations for recipients of the National Technology Medal.

The National Bureau of Standards has long had a program to foster the exchange of scientific and technical personnel. In view of budgetary limitations, I am not certain we will be able to conduct the joint DoC/NSF program specified in the Act. We will, of course, explore this question with the National Science Foundation.

Mr. Chairman, I just want conclude by assuring the Subcommittee that we share your concerns and want to work with you toward achieving our mutual goal of helping American business increase its technological innovativeness and its productivity.

Dr. Ambler, Mr. Day and I will be pleased to answer any of your questions.

Mr. **Walgren**. Thank you very much, Mr. Wright.

Could we turn to Dr. Ambler for any statements? Or Mr. Day?

Dr. **Ambler**. I have no statement, Mr. Chairman.

Mr. **Day**. No statement, Mr. Chairman.

Mr. **Walgren**. Mr. Brown.

Mr. **Brown**. Mr. Wright, I am pleased with the fact that you have, in your statement, supported several of the concepts which are included in the act. I somewhat regret that it does not include the funding of some of these initiatives.

I think I can understand the philosophy behind it, but I'd like to have you elaborate a little bit more on the reasoning behind the lack of support for the university/industry centers for industrial technology, for example, and the cooperative research centers, which you have indicated you feel are important initiatives which might come about in future years.

Is your posture on these kinds of initiatives that they would be suitable for this administration under a different economic setting, but that in view of the budgetary stringencies for this year, that they are not sufficient to have priority?

Mr. **Wright**. Mr. Congressman, I don't believe anybody in this room questions that budgetary constraints this year must be an important part of any decision process. We feel that one of the more important parts of the entire present economic recovery program is to reduce Federal expenditures; so that it is a factor.

However, I would like to say that an equally important factor is our lack of ability at the present time to effectively pinpoint those areas where effective technology and productivity innovation are needed and exactly what are the problems that have caused our productivity to grow at a reduced rate in this country for over 20 years.

At the present time, I have traveled—I can't tell you how many cities—to productivity centers. And those people are truly interested in this. And you will always get a different reason as to exactly what is causing this.

But on the same note, you will get the different reasons as to what is causing the reduction in technology development, compared to Japan, compared to West Germany, and some of our other trading competitors.

I believe it is extremely vital that within the Department we use our ability to collect and analyze our economic as well as our technological and productivity information to start pinpointing those areas where the problems really and truly are, to come up with useful discussions for improvements, and then start working with the private sector on making those improvements, rather than just sending money out that is perhaps not directed as well as it should be. I don't think we can afford that.

Mr. **Brown**. Mr. Wright, I can't believe you're really serious about the need to make further analysis of the factors involved. This has been the subject of intensive knowledge over many years' analysis. And while I don't think that any system of data collection will automatically reveal the answer, you have pinpointed most of the answers in your own paper.

There is a lack of savings. There is a phenomenon we have recognized for years, which is a lack of commitments to investment *in R. &. D., a factor we have recognized for many years.*

There are intangibles. You know, there's not a dedicated commitment to the national welfare, such as perhaps the Japanese society has. That's going to be very hard to measure statistically, although I welcome any efforts you might make.

These factors were pointed out in the report that was initiated and made under the last administration. And this committee and the committee on which Senator Stevenson and Senator Schmitt sit, castigated the administration in making their proposals, because they didn't focus on some of the things you're focusing on. And we will, correspondingly, commend you for focusing on the need for improved climate of the Government and economic climate that will facilitate some of these things.

But certainly the problem is not basically one of lack of information with regard to the general factors inhibiting our innovation productivities. Perhaps you could amplify on why you think it is.

I can see some basis for further information that would pinpoint, sector by sector, something that you emphasize. But what you will merely do in that is to identify the degree to which specific sectors and industries don't meet these criteria for successful innovation and productivity that you have already outlined, in that they are not committing enough money to savings, they're putting too much into short-run profit, and some other things of this sort.

But if you would care to amplify on your thinking, sir, I'd appreciate it.

Mr. WRIGHT. Yes, sir. I certainly will.

The overall generic problems which have existed, as you mentioned, in terms of capital formation, whether it be the savings rates, the tax disincentives——

Mr. BROWN. Regulatory——

Mr. WRIGHT [continuing]. Regulatory impediments, the increased cost of energy, et cetera, and we believe that the package that is being proposed right now will be a major step toward addressing some of that.

Mr. BROWN. We would agree with that.

Mr. WRIGHT. On the other hand, the centers that we're talking about were specifically directed toward individual industries or applications, and we do not believe that we will ever have enough funding to spread across the entire board of American industry all of the specific applications that are needed in order to improve technology and productivity. That is where we strongly feel that additional analysis is needed. We have the information, but we simply have not put it together on a sector-by-sector basis to the point where we can come in and order our priorities for the American economy, sector by sector, and determine where the improvements are needed. That is where we think we have a major emphasis.

Again, we believe that we have the information. We simply have not put our resources together within the Department.

Mr. BROWN. Let me pose this question to you. If after a reasonable period of time after the adoption of the President's economic program, if the regulatory climate is improved, the investment climate is improved, there is an increase in the national rate of savings, if we still find that there are problems with regard to encouraging our industries engaging in adequate investment in innovation and productivity improvement, and our competitive position still seems to be lagging in global markets, do you envision some more specific types of activities being favorably looked upon by this administration?

And I'm thinking not just of what is in Stevenson-Wydler, but other efforts to pinpoint the Government role in providing aid incentives or whatever it takes to get American industry off the dime.

Mr. Wright. Mr. Congressman, I feel that, with the implementation of the tax packages up right now, along with the information that we are going to be able to provide right now, incentives will be there for American business to work with university structure or with whatever private associations they have to do it on their own. And I do not believe there will be a problem with them picking up the ball and running with it. It is in their own interests, as well as ours.

Mr. Brown. Well, I agree with you that it's in their own interests. I don't agree with you there would be a problem of picking up the ball. And I have watched industry sectors 25 years not pick up the ball—the automobile industry, the steel industry, the utility industry. Some of them are just beginning to pick up the ball when they're faced with collapse. In other words, under crisis conditions, they begin to pick up the ball.

Now, I don't think you can contend that the problem has been solely repressive Government regulations and excessive taxation over the last 25 years. With the utility industry, which, to their great credit, has begun to engage in a great deal more innovation and improvements in productivity, in part under the auspices of the joint research organizations, like the Electric Power Research Institute, there has been the beginning of a turnaround—not complete, but in some cases a great improvement. But that was due to a change in the their attitude and not basically to change in the Government role.

And I would say the same thing is probably necessary in auto and steel, the two major components of American industrial strength, which has been disappointing in the past.

Mr. Wright. Mr. Congressman, I would say that we do have a disagreement here on this one. And I would suppose the next several years will just tell us which one is going to be right.

But I feel that if the Federal Government can just get rid of some of the disincentives that have existed, I have enough faith in American business that it will pick up the ball.

Mr. Brown. Well, I'm not denying your faith. I may have too little faith, and you may have too much faith. And somehow or other we'll have to reach a compromise here.

I'm asking you if, after a reasonable period of experimentation, you personally—and this administration, based upon the improved data collection processes and the records of performance, sector by sector, and so forth, that you undoubtedly will have by then, that you would feel it would be appropriate to turn to other methods?

Or shall we let the processes of collapse and rebirth take care of the matter?

Mr. **Wright**. Well, the collapse and rebirth is a serious way to be looking at this. But historically, it is a process that has always occurred in certain parts of the economy. I think it now depends on whether or not we feel it's the Federal Government's role to take a socialized approach toward American business.

And I'm sorry, Congressman, I, for one, do not believe that it is appropriate.

Mr. **Brown**. Well, I don't think we're talking about socializing the American industry at this point. I think we're talking about some proper combination of Government and private initiatives which will solve some very serious problems.

Mr. **Wright**. And I agree with that, Mr. Congressman.

Mr. **Brown**. Thank you.

Mr. **Walgren**. Mr. Skeen.

Mr. **Skeen**. I have no comments. Thank you.

Mr. **Walgren**. Someone asked me over the weekend what the liberal was doing in Washington these days. And my reaction was that I thought that what people in Washington should be doing was looking for what works in a practical way, regardless of labels, liberal or conservative, or the like. And there are areas where you can look at a program and say that this has been beneficial, this has added more than it has subtracted from our economy.

I wonder if, looking at our present experience with the technology transfer efforts in the Department of Commerce, whether that can truthfully be said?

You say you are not expanding the centers, on the other hand, because we already have some effort in the National Science Foundation and we also have some effort in the Department of Commerce; do we not?

Mr. **Wright**. In terms of what, Mr. Chairman?

Mr. **Walgren**. In terms of what a center for technology transfer would do, what it would add to our——

Mr. **Wright**. We currently have that already, primarily within the National Bureau of Standards. And we believe we will be actually expanding our ability between NBS and NTIS in order to provide technology transfer.

Now, what you have to watch out for is actually giving financial contributions or support to the private sector for providing this information. And we do not feel that that is appropriate for the Federal Government.

Mr. **Walgren**. But looking at the Bureau of Standards' experience with the concept of a center, whatever would go on in the center, that has already gone on to a certain degree in the Bureau of Standards, you have brought together industry and university people within the Department of Standards; have you not?

Mr. **Wright**. I want to ask Dr. Ambler to respond to that directly.

Dr. **Ambler**. I'm not sure that we do it in the sense of having a center. We do it throughout all of our programs. Our mission calls upon us to work with industry and State and local governments, and we do this in the most detailed way. It's very much a part of the fabric of the institution, I would say.

Mr. **Walgren**. But we do have an experience where industries send employees and universities send representatives to work on problems of mutual benefit, as Mr. Wright had indicated in his testimony. And my question is, looking at that experience, can you say that that has made a positive contribution to the near-term economic health of the entities involved?

Dr. **Ambler**. I think it's a very beneficial program and one we regard very highly. In fact, the program that you're alluding to—the industrial research associates program—is one that we determined that we want to try to expand considerably over the next few years. Of course, that depends on industry being responsive, just as it depends on our own desires and efforts.

Mr. **Walgren**. And those are not just desires. These must be based on some actual hands-on experience, with the benefit that can come out of such relationships?

Dr. **Ambler**. Yes. It's a mutual benefit.

Mr. **Walgren**. Has there ever been an evaluation of what has come out of those joint efforts on a cost-versus-benefit basis?

Dr. **Ambler**. No, I don't believe there has been a cost-benefit analysis done very systematically. We do, on some of the programs, try to do just that but it's not very easy and it tends to be rather expensive. But we do do it.

For example, the work that we did over the last several years in the area of measurement techniques for quality control of integrated circuits is one area that we have done a very careful economic study—cost-benefit study—but that's not done on all the programs.

Mr. **Walgren**. What would the result of that particular evaluation, that particular activity be? Would that make a substantial contribution to that area of our economy that would not exist had you not engaged in that program?

Dr. **Ambler**. Yes. The effort that the Bureau of Standards has in this area is very specialized, as you know, and by comparison with the total, that area is relatively small. Accordingly, our analysis is confined to what effect our measurement techniques and standards have had on productivity in the integrated circuit industry. And I have forgotten the actual number, but it was rather impressive.

Mr. **Walgren**. Rather impressive?

Dr. **Ambler**. Yes.

Mr. **Walgren**. The point I would like to make, from my point of view, is that in a practical measure, aside from the spirit of this program or spirit of that program, it seems to me we ought to be able to agree on what works and what action makes a contribution. I'm sure we approach these from starting points. I guess I, too, would like to underscore the feeling that I personally have, that this seems to be a needed Government effort in that it has not happened in the past, or it has not happened extensively in the past, even at times when certain industries were doing very well.

And so, to the degree that these efforts do not presently exist in our society, it seems to me that we can't lay that simply on the door of the present tax burden or present depression in the industry.

Various industries have done quite well throughout business cycles, and still we do not see, I guess, the degree to which I hope we could agree, as a practical matter, that this kind of effort should exist in our society. So, I would just offer that thought for your consideration.

Mr. **Wright**. Mr. Chairman, may I make one comment?

Mr. **Walgren**. Sure.

Mr. **Wright**. I agree with you in principle, but I would say the tax disincentive is an important part of every businessman's plan, and that disincentive to invest in capital formation, as well as resource development, has existed for some time. And I believe that that is a substantial change that could occur this year.

Mr. **Walgren**. Along that line, can I ask whether the administration supports the targeted tax credits for research and experimentation that have been proposed by, I guess, various people in Congress?

It's my understanding that there is a proposal to give a 25-percent tax credit for qualified research and experimentation funds, along with attempts to also qualify university/private sector commitment of funds in that area, and also encourage industry to make donations of research equipment.

Does the administration support that kind of specific encouragement to fill the gap that we see here?

Mr. **Wright**. Yes, sir, Mr. Chairman. My understanding on that package is that there is a 3-year depreciation schedule on research and development equipment and expenditures, and a 25-percent tax credit for incremental R. & D. over the average of the prior 3 years' expenditures. That's my understanding of the proposal.

Mr. **Walgren**. That's different than the general depreciation changes that I've talked of.

Mr. **Wright**. Yes, sir.

Mr. **Walgren**. Specifically focused on research?

Mr. **Wright**. Yes.

Mr. **Walgren**. And would experimentation be involved in that?

Mr. **Wright**. I believe it would, Mr. Chairman, but I'm not quite sure.

Mr. **Walgren**. Mr. Gregg?

Mr. **Gregg**. I'm not sure that this is the place to get into a tax discussion, but I wasn't really aware as to what the Chair's question was on R. & D. tax benefits.

Mr. **Walgren**. Well, I was just interested in whether or not the administration supported specifically targeting tax incentives on this kind of a problem, as opposed to some broad, general effort of tax reduction that would include a tax reduction on gas-guzzling automobiles.

Mr. **Gregg**. Thank you.

No, I have no questions.

Mr. **Brown**. Mr. Chairman?

Mr. **Walgren**. Mr. Brown?

Mr. **Brown**. Could I offer a comment?

Mr. Wright, I didn't comment on your reference to section 5(c) of the act, which I gather that you feel can be carried out as a part of the on-going initiatives that you suggested with regard to the improvement in the collection of data.

Mr. **Wright**. Mr. Congressman, I have been going through all the pieces of 5(c), and I believe I did mention that.

Mr. **Brown**. Well, I think that I want to take up an opportunity to commend you on that. One of the fundamental problems that this subcommittee has focused on for a number of years has been the problem of improving the U.S. role in the collection and dissemination and management of scientific, technological, and what one of our country's great consulting firms called "societal information," and I note that you have a very extensive background in the management of large-scale data collection and management systems.

A good part of the problem—I don't know how much—of solving or encouraging innovation and productivity, and certainly utilizing Federal resources more effectively, is in the management of information; and I think that an aggressive pursuit of the initiatives that you have outlined for securing information, and trying to implement the provisions of section 5(c) would have extremely useful results in terms of solving this problem.

And I want to make it clear that I am not being negative about this at all. I could construe this as a copout for not spending more money, but I really don't think it is. I think the problem is much more important than that, and I would hope that in connection with your own background in management of large-scale data systems, that you would look at some of the prior studies that have been done on the Federal Government role in scientific, technological, and societal information, and determine if your office can't possibly be a central point in the Government, for bringing about some of the needed changes.

This is a role which is, by law, alluded to, at least in the Science and Technology Policy Act, which sets up the office of Science Advisor to the President. I don't see that office as having the resources necessary, and possibly it shouldn't.

But I see the immense facilities of the Department of Commerce as being the core for this, and I would want to encourage a person with your obvious knowledge and expertise in this area to see if you could bring about some rationalization of this, in the same spirit that we passed the Paperwork Reduction Act, which does not so much cover this area of scientific and technological information, as it does the basic information that the Government collects from business and private enterprise.

But the two are part of the same package, and need to be considered together. I would ask you if you have given any thought to the possible role of your office in this connection, or if you would be willing to examine that problem, which has frustrated us for many years, with the idea of bringing about some improvement in the situation.

Mr. **Wright**. Congressman, we would be delighted to go ahead and look at that particular situation. We have not given that any specific thought, because we believe the task of just doing what I described within my testimony is going to be enough to keep us busy for at least a couple of years.

We will look at that, because I can remember how, during my years in the private sector running a company, I was continually deluged with Government information that I couldn't take action on. And one of the things we considered—both Secretary Baldrige and myself—as a major priority is to try to convert an enormous wealth of resources that we have, in terms of information collection and analysis, into action recommendations that American business could do something with.

We do not mean to overpromise, because this is not the easiest task, and I don't want to be like so many Government people who go to their constituencies and say they see light at the end of the tunnel, and them come back to Washington and find there's a little more tunnel. We don't intend to do that. We're taking this job seriously, we are considering the expansion of the area you're talking about, and we think you will see some results in the next several years.

Mr. **Walgren**. Well, Mr. Wright, if I may just make reference to the last major report in this area, prepared by Arthur D. Little—and I'm sure if you had done it, representing Booz, Allen & Hamilton, you would have come to similar conclusions. I would hope that you would look at that, and see if it would give you any ideas as to the role you might play in providing leadership in resolving some of the problems we have discussed.

Mr. **Wright**. I'll be glad to do that, Mr. Congressman.

Mr. **Walgren**. I'd like to ask two other things.

One is: Dr. Ambler, section 11 of the act sets out certain requirements for technology transfer. Is the Bureau of Standards doing anything different after the Stevenson-Wydler Act than they were doing before Stevenson-Wydler?

Dr. **Ambler**. Yes, it is. Of course, the first thing that we did was to create this Office of Research and Technology Applications, and to make sure that it was staffed adequately with a director, with a person whose sole responsibility was industrial liaison, and another person as State and local government liaison.

And then, we set about trying to determine how much we were spending on technology transfer; and we quickly realized it was far more than the 0.5 percent. We simply counted the programs that we had, that were primarily directed to that end; and that amounts to 10 percent of our total budget, about $16 million all together. And that doesn't include the day-to-day contacts and all the other ways technology transfer is accomplished.

We got more deeply involved in the Federal Laboratory Consortium. This was a direct effect of the Stevenson-Wydler Act, and we are on the Board of Directors of that institution.

We are the prime editor of the Directory of Federal Laboratories, and we have helped organize the Washington chapter of the Technology Transfer Society. This effort that we are mounting, that I referred to earlier, in increasing our industrial research associates program, was a direct result of the Stevenson-Wydler Act. These are some additional things that we did following the passage of the Stevenson-Wydler Act.

Mr. **Walgren**. Are there any Federal laboratories that might not be making necessarily 10 percent—but a major or significant information transfer?

Dr. **Ambler**. I really haven't looked into that, sir. I really don't know.

Mr. **Walgren**. The testimony is that those within the range of Commerce are making that kind of an effort.

Mr. **Wright**. Mr. Chairman, we have instructed them to, and we will be auditing them.

Mr. **Walgren**. What about laboratories beyond the range of Commerce? Are there any?

Dr. **Ambler**. With your approval, Mr. Chairman, Dr. Sorrows is here. He's our Director of the Office of Research Technology Applications. He may be able to give a more detailed answer than Mr. Wright or myself.

Mr. **Walgren**. Please.

Dr. **Sorrows**. One other comment which comes to mind is that the Federal Laboratories Consortium, which represents about 190 of the Federal laboratories around the country, is looking into the problem very seriously. And they are determining how they can both work independently and together; and they are setting up a directory of all their activities that might be available. They're setting up tools of the trade, or guides to how to transfer technology better.

They're taking a very serious and sincere look into the problem of technology transfer, in keeping with the type of technology transfer which is addressed by the Stevenson-Wydler Act; namely, the active transfer of technology.

Mr. **Walgren**. Without objection, perhaps it would be appropriate for the staff to inquire of that particular Federal Laboratories Consortium.

Let me then ask, on behalf of Wes Watkins, who is on the appropriations committee, and has had an ongoing interest in technology transfer in particular. He wanted to explore the fiscal year 1981 supplemental appropriations bill, which restored some of the funding for the Economic Development Administration that the President had sought to rescind. The Appropriations Committee indicated that the restored funds would be allocated to those projects in which the EDA had a commitment to fund such routine annual renewal of multi-year technical assistance projects.

Mr. Watkins understands that there was not enough money restored to renew all the pending technical assistance grants and that, as a result, EDA had planned to allocate the money pro rata, among the presently existing funding strings. Some of these technical assistance projects, including one that he is particularly interested in—fund technology transfer and innovation center activities.

And then the question is: Wouldn't it be wiser to use these limited dollars on a target basis?

And if such an evaluation were made, wouldn't technology transfer and innovation centers, which may be funded through the EDA, perhaps justify a full investment or full funding, compared to some of the other activities that EDA is engaged in?

Mr. **Wright**. Mr. Chairman, you've really asked several questions.

First of all, you are correct in the statement that it will be an allocation among the technical assistance grantees, which I believe takes them through the end of this calendar year, across the board.

Second, would it be wiser to target? It always is. It always is, in my opinion, wiser to target, if you have the time and, very honestly, you can do it politically. But to go through the process right now with those grantees that are out there, and to eliminate one over a few others—well, that's been one of the problems we have had in EDA over the years.

In the long term, would that approach be an effective use of the Economic Development Administration? I suppose that's a real question, because the overall purpose for the Economic Development Administration when it was originally founded was, through the creation of business, to provide long-term jobs in distressed areas. And you know you have a hard time identifying a distressed area when over 80 percent of the country seems to be labeled "distressed."

So I'm not sure that would be a proper area for that type of program.

Mr. **Walgren**. Anybody have anything further?

[No response.]

Mr. **Walgren**. Thank you very much. We appreciate your contribution.

[Mr. Wright's answers to questions from the subcommitee and Mr. Watkins follow:]

THE DEPUTY SECRETARY OF COMMERCE
Washington, D.C. 20[illegible]

NOV 5 1981

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Honorable Doug Walgren
Chairman, Subcommittee on Science,
  Research and Technology
Committee on Science and Technology
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

Enclosed are my answers to your and Mr. Watkins' supplemental questions for the record of the hearing on implementation of the Stevenson-Wydler Technology Innovation Act held by the Subcommittee on Science, Research and Technology.

Our budget estimates for fiscal year 1982 are the best available at this time.

Sincerely,

Deputy Secretary

Enclosure

Questions by Congressman Watkins for
Deputy Secretary of Commerce Joseph R. Wright, Jr.

1. Last fall I was interviewed by a representative of M. L. Grad Associates concerning the Technology Commercialization Program of, and the technology commercialization centers supported by, the Minority Business Development Agency. It is my understanding that these centers, which incidentally were conceived in 1974, are providing a unique technology brokering and commercialization function primarily for the benefit of minority entrepreneurs.

(a) Has the Department considered using that successful model in its implementation of Pub. L. No. 96-480?

The President's fiscal year 1982 budget does not include funding to conduct a centers program of the type envisioned in the Stevenson-Wydler Technology Innovation Act. However, the Department, upon request, will provide, to the extent feasible, technical assistance to non-Federally funded cooperative research and entrepreneurial training and assistance centers.

The Department is carefully examining the Minority Business Development Agency's (MBDA's) extremely successful Technology Commercialization Program (TCP) as a possible model for its center activities and its technology transfer activities. Since the TCP depends almost entirely on private sector involvement and funding, the TCP is an especially good model. To increase private access to technological opportunities, we are also considering better linking MBDA's TCP network (8 centers, some 20 government agencies, and more than 40 national corporations) with this country's National Laboratory system.

(b) Since the program depends essentially on private sector involvement to commercialize technology-based products, what support from the Department level has been provided to MBDA's Technology Commercialization Program?

The National Bureau of Standards (NBS), the Office of Administrative Services, and the Office of Public Affairs, have provided MBDA with support services for the TCP.

NBS has provided technical evaluations for a number of TCP projects. These evaluations played a substantial role in obtaining private sector financing, marketing and further development for the projects.

The Office of Administrative Services has provided access to Departmental computers which store and retrieve information on over 100 TCP projects. Departmental computers are also used for the MBDA "Profile" system which, by the beginning of fiscal year 1982, will contain information on over 8,000 minority firms. Over 600 of the 8,000 firms listed are engaged in manufacturing, research, and development.

The Department's Office of Public Affairs has published articles on TCP projects in the widely read "Business America." The Office of Public Affairs has also interviewed several minority firms in the TCP program and has distributed tapes of those interviews to over 500 radio stations.

For fiscal year 1981, the Department, through MBDA's budget, allocated $1.291 million to the TCP program and for fiscal year 1982, has allocated $1 million. This money is distributed as grants to the Program's Technology Commercialization Centers for staffing and for funding product evaluation and development.

2. What specific new initiatives in technology transfer has the Department of Commerce launched since enactment of Pub. L. No. 96-480? In other words, what is the Department now doing in technology transfer that it was not doing prior to passage of the Stevenson-Wydler Technology Innovation Act?

   The National Technical Information Service (NTIS) of the Department has undertaken several new intiatives. First, a new interdisciplinary biweekly newsletter "Information for Innovators" was launched in the latter part of 1980. Each issue highlights eight to ten significant technology developments. The newsletter attempts to predict the practical significance of each development and identifies background reports on the development available from NTIS. A copy of the August 4, 1981 newsletter is attached.

   Second, in cooperation with the Patent and Trademark Office, NTIS in fiscal year 1982, is initiating two new patent information services to alert U.S. industry to recent foreign patents. The first will provide one page abstracts of new foreign patents together with a listing of references. The service will be by subscription ordered for SIC classifications rather than by technical disciplines. The second service will provide analyses and forecasts for recent foreign patents in specific fast moving fields, such as robotics and machine tools, each affecting many diverse industries.

Third, in early fiscal year 1982, NTIS will collect and market the Technology Application Assessment Reports required by the Stevenson-Wydler Technology Innovation Act to be prepared by each Federal laboratory's Office of Research and Technology Applications, will collect the biennial reports on technology transfer activities required by the Act to be prepared by Federal agencies, and will answer Congressional inquiries regarding the status of technology transfer throughout the Federal Government.

Finally, NTIS has begun a new program to index and disseminate technical information resulting from research and development funded by foreign governments and industries. Substantial document accessions have already occurred. Important documents or abstracts not available in English will be translated.

A number of new activities are part of the Department's National Bureau of Standards (NBS) on-going technology transfer programs. For example, NBS has established a computer-based communication system to enable it to promptly answer technical inquiries from State and local governments.

As part of its Recycled Materials Program, NBS has established a Resource Recovery Technical Advisory Center. The Center is currently sponsoring studies by the Association of State and Territorial Solid Waste Management Officials. A NBS professional is currently on an extended Intergovernmental Personnel Act assignment with the California Solid Waste Management Board and the California Department of Health.

The DOE/NBS Energy Related Inventions program is sponsoring a series of National Innovation Workshops around the country. The NBS Office of Energy Related Inventions has also sponsored information centers for inventors in libraries in Atlanta, Georgia; Boston, Massachusetts; and Sunnyvale, California.

3. The FY 1981 Supplemental Appropriation Bill restored some funding for the Economic Development Administration that the President had sought to rescind. The Appropriation Committee Report indicated that the restored funds were to be allocated to those projects to which EDA had a commitment to fund, such as routine annual renewals of multi-year technical assistance projects.

   I understand there was not enough money restored to renew all pending technical assistance grants, and EDA plans to allocate the money on a pro-rata basis. Some of these technical assistance projects, including one in my Congressional District, fund technology transfer and innovation center activities.

Wouldn't it be a wiser use of scarce dollars to fully fund those projects of a high priority nature, and terminate those projects which are duplicative or of lesser priority? This approach also might help the Department keep its commitment to promotion of innovation and productivity, as well as assisting in the implementation of Pub. L. No. 96-480.

> EDA did not distribute its limited technical assistance funds on a pro-rata basis. Rather, applications for funding were reviewed and funds were distributed according to the priority of the project considering its potential and its relation to the Administration's goals.

Questions by Chairman Walgren for
Deputy Secretary of Commerce Joseph R. Wright, Jr.

1. The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established at each Federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office may elect to combine the Office within the existing organization.

    (a) Please provide the Subcommittee with a list of Federal laboratories owned and funded by your agency (whether or not operated by your agency).

    (b) For each laboratory on the list described in (a) please give

        (i) the total annual budget for FY 1981

        (ii) the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applications. If the ORTA is combined with an existing organizational structure, name the structure.

Laboratory and ORTA Chief Staff Person	Total Budget For Laboratory for Fiscal Year 1981
1. The National Bureau of Standards. Dr. Howard E. Sorrows Director, Office of Research and Technology Applications National Bureau of Standards Administrative Building, Room A-402 Washington, D.C. 20234 (301) 921-2226	$104,095,000
2. The Institute of Telecommunication Sciences of the National Telecommunications and Information Administration. Russell B. Stoner Public Information Officer Institute of Telecommunication Sciences Department of Commerce Boulder, Colorado 80303 (303) 497-3572	$4,140,000

3. The Office of Oceanic and Atmospheric Services (OOAS) of the National Oceanic and Atmospheric Administration. $27,816,000

Office of Technology and Engineering Services

Advanced Technology Office $5,774,000
Dr. J. Cawley
NOAA
6010 Executive Blvd.
Rockville, Maryland 20852
(301) 443-8385

Engineering Development Office $2,000,000
C.D. Kearse
6301 Lafayette Avenue
Riverdale, Maryland 20840
(301) 436-6914

Engineering Support Office $1,904,000
Dr. J. Solomon
180 Washington Navy Yard
Washington, D.C.
(202) 426-9076

NOAA Data Buoy Office $12,138,000
Dr. J. McCall
NOAA-Natl Space Technology Lab
NSTL Station, Miss. 39529
(601) 688-2800

National Weather Service

NEXRAD Project $5,000,000
Mr. Sam Williamson
NEXRAD Joint System
Program Office
Gramax Building
8060 13th Street
Silver Spring, Maryland 20910
(301) 427-7150

National Ocean Survey

Geodetic Research and Development Laboratory Bruce Douglas 424 Rockwall Building Rockville, Maryland 20852 (301) 443-8556	$1,000,000
4. The Office of Research and Development (ORD) of the National Oceanic and Atmospheric Administration.	$56,835,000
Aeronomy Laboratory Dr. Eldon Ferguson, Director 325 Broadway Boulder, Colorado (303) 320-3218	$2,982,000
Air Resources Laboratories Dr. Lester Machta, Director 8060 13th Street Silver Spring, Maryland 20910 (301) 427-7645	$3,741,000
Atlantic Oceanographic and Meteorological Laboratories Dr. Hugo Hezdek, Director 4301 Rickenbacker Causeway Miami, Florida 33149 (305) 350-1300	$7,897,000
Geophysical Fluid Dynamics Laboratory Dr. Joseph Smagorinsky, Director P.O. Box 308 Princeton, New Jersey 08540 (607) 345-6502	$9,333,000
Great Lakes Environmental Research Laboratory Dr. Eugene Aubert, Director 7300 Washtenaw Avenue Ann Arbor, Michigan 48104 (313) 378-2244	$3,146,000
National Severe Storms Laboratory Dr. Edwin Kessler, Director 1313 Halley Circle Norman, Ohlahoma 73069 (405) 763-4916	$2,305,000

Office of Weather Research and Modification Dr. Charles Chappel, Act. Dir. 325 Broadway Boulder, Colorado 80303 (303) 320-6382	$2,967,000
Pacific Marine Environmental Laboratory Dr. John Apel, Director 3711 15th Avenue, N.E. Seattle, Washington 98105 (206) 399-0199	$4,160,000
Prototype Regional Observing & Forecasting Service Dr. Donald Beran, Director 325 Broadway Boulder, Colorado 80303 (303) 320-6755	$3,599,000
Research Facilities Center Dr. C.B. Emmanuel 3401 N.W. 59th Avenue P.O. Box 520197 Miami, Florida 33152 (305) 350-2936	$4,264,000
Space Environment Laboratory Dr. Donald Williams, Director 325 Broadway Boulder, Colorado 80303 (303) 320-3311	$2,826,000
Wave Propagation Laboratory Dr. C.G. Little, Director 325 Broadway Boulder, Colorado 80303 (303) 320-6261	$9,615,000
5. The National Environmental Satellite Service (NESS) of the National Oceanic and Atmospheric Administration.	$9,730,000
Earth Science Laboratory Dr. Edward Epstein, Director World Weather Building 5200 Auth Road Camp Springs, Maryland (301) 763-8031	$3,635,000

Satellite Experiment Laboratory Dr. Won Hovis, Director Federal Building #4 Washington, D.C. 20233	$2,170,000
Applications Laboratory Dr. J.T. Rao, Director World Weather Building 5200 Auth Road Camp Springs, Maryland (301) 763-8282	$3,250,000
Development Laboratory Dr. William Smith, Director Space Sciences & Engineering Center, NOAA University of Wisconsin 1225 W. Dayton Street Madison, Wisconsin 53706 (608) 252-5325	$675,000
6. The National Marine Fisheries Service of the National Ocean and Atmospheric Administration. The budget figures for each of the entities listed under a center or office are part of the budget figure listed for the center or office.	$59,807,800
Northwest and Alaska Fisheries Center George Tanonaka Program Planning Officer 2725 Montlake Blvd., E. Seattle, Washington 98112 (206) 442-1540	$18,151,000
Seattle Laboratory George Tanonaka Program Planning Officer 2725 Montlake Blvd, E. Seattle, Washington (206) 442-1540	$11,360,000
Auke Bay Laboratory Dr. George Snyder Director P.O. Box 155 Auke Bay, Alaska 99821 (907) 789-7231	$3,260,000

National Marine Mammal Laboratory Dr. Michael Tellman Director 7600 Sand Point Way, N.E. Seattle, Washington 98115	$1,552,000
Northeast Fisheries Center LCDR Ronald J. Smolowitz Technical Projects Coordinator Woods Hole, Massachusetts 02543 (617) 548-5123	$16,760,000
Gloucester Laboratory Louis J. Ronsivalli Director Emerson Avenue Gloucester, Massachusetts 01930 (617) 281-3600	$988,700
Milford Laboratory James E. Hanks Director Milford, Conn. 06460 (203) 878-2459	$1,749,700
Oxford Laboratory Dr. Aaron Rosenfield Director Oxford, Maryland 21654 (301) 226-5193	$520,400
Narragansett Laboratory Kenneth Sherman Director RR 7A Box 522A Narragansett, Rhode Island 02882 (401) 789-9326	$1,505,600
Woods Hole Laboratory Richard G. Hennemuth Director Woods Hole, Massachusetts 02543 (617) 548-5123	$6,436,500
Sandy Hook Laboratory Dr. Carl J. Sindermann Director Highlands, New Jersey 07732 (201) 872-0200	$2,901,600

National Systematics Laboratory $327,900
Dr. Daniel M. Cohen
Director
Washington, D.C. 20560
(202) 357-2552

Southwest Fisheries Center $9,869,000
John Carr
Deputy Director
P.O. Box 271
La Jolla, California 92038
(714) 453-2820

La Jolla Laboratory $5,417,000
John Carr
Deputy Director
Southwest Fisherires Center
P.O. Box 271
La Jolla, California 92038
(714) 453-2820

Tiburon Laboratory $1,265,000
Norman J. Abramson
Director
3150 Paradise Drive
Tiburon, California 94920
(415) 435-3149

Honolulu Laboratory $2,296,000
Richard S. Shomura
Director
P.O. Box 3830
Honolulu, Hawaii 96812
(808) 946-2181

Pacific Environmental Group $491,000
Gunter R. Seckel
P.O. Box 831
Naval Postgraduate School
Monterey, California 939402
(408) 373-3331

Southeast Fisheries Center $14,564,800
Dr. R.J. Berry
Deputy Director
75 Virginia Beach Drive
Miami, Florida 33149
(305) 361-4286

Beaufort Laboratory Dr. Theodore Rice Director P.O. Box 520 Beaufort, North Carolina (919) 728-4595	$1,540,900
Charleston Laboratory Harry L, Seagran Director P.O. Box 12607 Charleston, South Carolina 29412 (803) 724-4770	$2,173,100
Miami Laboratory Dr. William J. Richards Director 75 Virginia Beach Drive Miami, Florida 39149 (305) 361-5761	$798,300
Panama City Laboratory Eugene L. Nakamura Director P.O. Box 4218 Panama City, Florida 32401 (904) 234-6541	$934,400
Mississippi Laboratories Dr. Andrew J. Kemmerer Director 3209 Frederick St. P.O. Drawer 1207 Pascagoula, Mississippi 39567	$2,424,800
Galveston Laboratory Dr. Edward F. Klima Director 4700 Avenue U Galveston, Texas 77550 (713) 763-1211 ext. 501	$1,658,500
National Seafood Quality and Inspection Laboratory Spencer Garrett Director P.O. Drawer 1207 Pascagoula, Mississippi, 39567 (601) 762-4591	$463,000

2.(a) What is your agency's total research and development budget for FY 1982 expected to be?

Operating Unit	
National Oceanic and Atmospheric Administration	$165,421,000
National Bureau of Standards	$83,569,000
National Telecommunications and Information Administration	$2,817,000
Total R&D budget (within the meaning of the Stevenson-Wydler Act) for fiscal year 1982 for the the Department of Commerce	$251,807,000

(b) What is your agency's total budget for the technology transfer functions, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982?

Operating Unit	
National Bureau of Standards	$9,000,000
National Oceanic and Atmospheric Administration	$15,309,000
National Telecommunications and Information Administration	$5,030,000
Patent and Trademark Office	$4,162,000
National Technical Information Service	$21,950,000
Minority Business Development Agency	$1,000,000
Total Technology Transfer Budget for fiscal year 1982 for Department of Commerce	$56,451,000

(c) Please provide a breakdown of the technology transfer budget into whatever detail is used to calculate it.

Operating Unit

National Bureau of Standards (NBS)	$9,000,000

Within NBS the breakdown is as follows:

Office of Weights and Measures	$700,000
Standard Reference Materials	$840,000
Standard Reference Data	$3,000,000
Measurement Assurance Programs	$100,000
Recycled Materials-Waste Management	$30,000
Recycled Materials--Recycled Oil	$1,300,000
Consultations for Technology Transfer	$1,600,000
Computer Science and Technology	$130,000
Standards and Committee Activities	$600,000
National Voluntary Laboratory Accreditation	$700,000

Minority Business Development Agency	$1,000,000
Projected Funding for Minority Business Development Agency's Technology Commercialization Program	$1,000,000

The $1,000,000 will be used to support seven Technology Commercialization Centers (TCCs) as follows:

Southwest TCC (Arizona)	$100,000
New England TCC (Conn.)	$150,000
Mid-Atlantic TCC (Wash. D.C.)	$150,000
Mid-West TCC (Oklahoma)	$150,000
Far-West TCC (Cal.)	$150,000
Southeast TCC (Atlanta)	$150,000
Northwest TCC (Washington)	$150,000

Patent and Trademark Office (PTO)	$4,162,000

The PTO disseminates information contained in its patent file--the largest single repository of technological information in the world. This is done through the sale of copies of patents, the PTO's Public Search Room, and the PTO's Office of Technology Assessment and Forecast (patent activity analysis, publications, and special reports services). While the primary purpose of these activities is not the transfer of Government-owned technology (most patents are owned by other than the Government and the Public Search Room is used for many purposes including to check on the patentability of inventions), the dissemination of technical information is a component of these activities. While not meeting the definition of technology transfer in the House Report, these activities have been included here without attempting any breakout of the non-technology transfer components of them.

Patent Copy Sales*	$2,260,000
Public Search Room	$1,262,000
Technology Assessment and Forecast	$640,000

*A substantial portion of these funds are offset by patent copy sales receipts. Under Pub. L. No. 96-517, the entire cost of patent copy sales to the public will be recouped effective with the start of fiscal year 1983.

National Technical Information Service	$21,950,000

Funded by Appropriations

Government Inventions Program:	$300,000

This program is designed to improve private sector utilization of Government-owned patents by bringing selected inventions to the attention of U.S. industry through direct industry contact, promotion, and the issuance of royalty bearing incentive domestic and foreign patent licenses.

Foreign Technology Acquisition Program:	$500,000

This program is designed to increase U.S. industry's knowledge of, access to, and utilization of technical knowledge developed in other nations.

Dissemination of Patent Information Program:	$150,000

This program is designed to increase the private sector's awareness of the wealth of technical information contained in U.S. patent literature and to provide greater accessibility to this information.

Funded by User Charges

Dissemination of Technical Information to the Public: $21,000,000

Dissemination of technical information to the public is accomplished through the National Technical Information Service's information clearinghouse program on a fully self-supporting basis through user charges. The program encompasses the public sale of Government-sponsored research, development and engineering reports and other analysis prepared by Federal agencies, their contractors or grantees, as well as Government produced data bases and software programs. The amount reflected above represents estimated document sales relating to the technology transfer function as defined by the Stevenson-Wydler Technology Innovation Act. The estimate was prepared based on past experiences of document sales, subscription sales, data base sales, and sales of bibliographic products and services.

National Telecommunications and Information Administration (NTIA) $5,030,000

Reimbursements for Information Provided Other Agencies, Academia and the Private Sector $5,000,000

Most, if not all of the research and engineering work performed by the Institute for Telecommunication Sciences (ITS)--the laboratory sponsored by NTIA--will result in technology transfer, in the form of technical reports, computer programs, etc., being provided to other Federal agencies, academia, and the private sector. In this context, most of ITS' other agency reimbursable programs would fit this category. A rough estimate for this work for fiscal year 1982 is $5,000,000.

Technology Transfer Funded by Appropriations $30,000

Of $3,017,000 in appropriated funding for ITS for fiscal year 1982, approximately $30,000 will be used to provide and disseminate information.

National Oceanic and Atmospheric Administration	$15,309,000	
Subunit		
Office of Oceanic And Atmospheric Services	$206,000	
Office of Technology and Engineering Services		
Advanced Technology Office	$15,000	Tech. Meetings.
	$20,000	Exhibits.
	$15,000	NTIS.
TOTAL	$50,000	
Engineering Development Office	$13,000	Papers.
	$ 3,000	Workshops.
TOTAL	$16,000	
Engineering Support Office	$ 5,000	Workshops.
	$ 5,000	Papers.
	$ 5,000	Direct Communications.
TOTAL	$15,000	
NOAA Data Buoy Office	$25,000	Papers.
	$15,000	Exhibits.
	$10,000	Workshops.
TOTAL	$50,000	
National Weather Service		
NEXRAD Joint System Program Office	$10,000	AMS Conference.
	$15,000	Workshops.
TOTAL	$25,000	
National Ocean Survey		
Geodetic Research & Development Laboratory	$20,000	Workshops.
	$20,000	Publications.
	$10,000	Data Products.
TOTAL	$50,000	

Office of Research and Development	$6,190,000	
Aeronomy Laboratory	$60,000	Information diffusion* on aeronomy.
Air Resources Laboratories	$538,000	Information diffusion* on climate change and atmospheric transport.
Atlantic Oceanographic & Meteorological Laboratories	$158,000	Information diffusion* on weather and marine observations and resources.
Geophysical Fluid Dynamics Laboratory	$93,000	Information diffusion* on atmospheric modeling.
Great Lakes Environmental Research Laboratory	$162,000	Information diffusion* on marine observations.
National Severe Storms Laboratory	$95,000	NEXRAD.
	$115,000	Information diffusion* on severe storms and radar.
TOTAL	$ 210,000	
Office of Weather Research & Modification	$157,000	Information diffusion* on weather modification.
Pacific Marine Environmental Laboratory	$42,000	Information diffusion* on marine observations & predictions.

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*Dissemination of product and process oriented R&D results.

Prototype Regional Observing & Forecasting Service	$3,611,000	PROFS Total.
Research Facilities Center	$224,000	Information diffusion* on weather observations and predictions.
Space Environment Laboratory	$300,000	Satellite Sensors.
	$145,000	Information Diffusion.*
TOTAL	$445,000	
Wave Propagation Laboratory	$108,000	Skywave Radar.
	$110,000	Coastal Radar.
	$272,000	Information diffusion.*
TOTAL	$490,000	
National Environmental Satellite Service (NESS)	$6,800,000	
Earth Sciences Laboratory	$1,300,000	**
Satellite Experiment Laboratory	$1,800,000	**
Applications Laboratory	$3,000,000	**
Development Laboratory	$700,000	**

* Dissemination of product and process oriented R&D results.

**Technology Transfer projects crosscut several NESS Laboratories and include:

- Prototype Regional Observation & Forecast System (PROFS)
- Agriculture and Resources Through Aerospace Remote Sensing (AGRISTARS)
- Centralized Storm Information System (CSIS)
- Flash Flood Warning System
- Fruit Frost Warning System
- VISSR Atmosphere Sounder (VAS)
- Coastal Zone Color Scanner (CZCS)

National Marine Fisheries Service	$1,927,500	
Northwest and Alaska Fisheries Center	$675,000	
Seattle Laboratory	$125,000	Prepare and distribute to U.S. fishermen an atlas on the location and abundance of groundfish resources in the N.E. Pacific.
		Demonstrate technology for rapidly chilling and preserving Pacific Whiting at sea.
		Develop preliminary quality control guideline for frozen pollock.
		Provide information to extend the quality of fresh and frozen rockfish fillets.
	$50,000	Develop fish product processing and quality assessment technology.
TOTAL	$175,000	

Northeast Fisheries Center	$140,000	
Northeast Fisheries Center (itself)	$10,000	Provide technical information on request.
Gloucester Laboratory	$100,000	Demonstrate to industry the feasibility of supplying quality filets.
Milford Laboratory	$10,000	Information Transfer.
Oxford Laboratory	$20,000	Publications, conference and seminar participation, literature searches.
Southwest Fisheries Center	$285,900	
La Jolla Laboratory	$124,500	Develop and improve techniques and methods to measure fish numbers or biomass (acoustics, etc.).
Tiburon Laboratory	$161,400	Develop gear, processing methods and packaging for U.S. fisheries to initiate or increase foreign markets for domestically under utilized species.

Southeast Fisheries Center	$594,400	
Southeast Fisheries Center (itself)	$100,000	Daily fisheries statistics for "Market News" program to public and industry.
	$178,000	Data for the *Fisheries Digest* of U.S. fisheries statistics (public distribution).
	$50,000	Interaction with public in response to ad-hoc information requests.
TOTAL	$328,000	
Beaufort Laboratory	$59,000	Prepare and distribute to industry and the public status report and forcast on menhaden.
	$25,000	Interaction with public in response to ad-hoc information requests.
TOTAL	$84,000	
Charleston Laboratory	$12,000	Food process technology demonstration to industry

	$15,000	Microbiological technology transfers to industry (through FDA and state public health services).
	$2,000	Interaction with public in response to ad-hoc information requests.
TOTAL	$19,000	
Miami Laboratory	$1,000	Annual "Bluefin Tuna Newsletter" for public distribution.
	$5,000	Annual "Cooperative Gamefish Tagging Newsletter" for public distribution.
	$10,000	Interaction with public in response to ad-hoc information requests.
TOTAL	$16,000	
Panama City Laboratory	$3,000	Interaction with public in response to ad-hoc information requests.

	$5,000	Annual publication of technical memorandum on "Big Game Fishing in the Northern Gulf of Mexico".
TOTAL	$8,000	
Mississippi Laboratories	$18,400	Transfer of engineering technology to industrial, State, and Federal sectors.
	$2,000	Interaction with public in response to ad-hoc information requests.
	$79,000	Turtle excluder trawl technology transfer to shrimp fishermen.
TOTAL	$99,400	
Galveston Laboratory	$37,000	Transfer of aquaculture technology to industrial, State, and Federal sectors.
	$3,000	Interaction with public in response to ad-hoc information requests.
TOTAL	$40,000	

National Seafood Quality & Inspection Laboratory	$272,200		
		$13,000	Demonstrate specific methods to reduce salmonella contamination in fish meal.
		$49,000	Demonstrate changes in shrimp processing techniques to eliminate salmonella in shrimp products.
		$170,200	Develop and demonstrate rapid methods to assess product quality and safety of U.S. inspected fishery products.
TOTAL		$232,200	

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>>>>>>> Experiments with application of heat recovery technology to almost every possible heat source continue to be spurred by rising energy costs. One candidate being studied is reject heat from refrigeration systems. While most of the recovery technology is not new, the application has not been tried in many instances due to lack of familiarity with the concept of **reuseable energy.**

In the case of **heat recovery from refrigeration systems,** electricity is effectively used twice. First, electricity powers the refrigeration system for cooling, also producing a byproduct, rejected heat. This heat is then used for residential or **industrial process hot water.**

There are far-reaching implications in that deceptively simple description of energy used twice. First, the concept of dual heat sources could create potentially more **favorable economics for electric hot water heating.** Heat recovery technology could generate new **market opportunity** to swing customers over from gas to electric/recovered heat systems. While there is no technical reason why recovered heat cannot be applied to gas water heaters as well, the shorter payback economics are more persuasive as a result of replacing higher cost electricity with recovered heat.

Second, the daily load variations on an electric utility would be reduced as would be total annual demand related to water heating. Peak loads would be reduced because the more a refrigerating system—air conditioner, freezer, refrigerator—is used, the greater the supply of recovered heat, thus reducing the use of electricity for water heating.

Clearly the ideal location for introduction of heat recovery technology would be areas with hot summers and cool-to-cold winters. The economic benefits are greatest where heavy air conditioning and refrigeration requirements are coupled with heavy use of hot water. An ideal industrial application might be in food processing and food-related commercial establishments. Residential application would vary with geography and with the local cost of electricity. But even in Sun Belt States where alternative solar technologies might seem competitive, the economics of refrigerant heat recovery seem attractive.

For example, the retrofit **heat exchangers** for residential use range from $400-800 for units now produced only in small volumes. It is estimated that heat exchangers integrated with **air conditioners** or **heat pumps** by original equipment manufacturers (OEM's) would add only $250-300 to the installed cost. A typical first cost of solar water heating is $1,000-2,500.

Though the time and circumstances seem ripe for introducing heat recovery from refrigeration systems on a significant scale, nevertheless there are some impediments to such innovation. One barrier is institutional: Major manufacturers of air conditioning and heat pump equipment face a strong **disincentive for market development of added heat recovery equipment.** That's because residential heat recovery for water heating was not considered in the initial Federal energy legislation. Consequently, there are no Department of Energy test standards for units where the heat recovery coil and controls are integrated at the time of manufacture. So the required **energy efficiency labels** cannot advertise the additional savings achieve by twice-used heat. Furthermore, there is still uncertainty about where credits will be allowed for **residential heat recovery units** because this technology is not covered explicitly in the National Energy Act.

A second barrier to innovation is technical as it relates to future requirements for **potable water protection.** Several major cities now require Underwriters Laboratory approval and the use of a **fail-safe type heat exchanger**, a requirement which is expected to become a universal standard, removing the uncertainties about design strategies for the marketplace.

A similar, though also not insurmountable barrier involves **warranties** on existing air conditioning/refrigeration equipment. One could expect most air conditioner manufacturers to continue their present practice of honoring existing warranties if retrofit heat recovery equipment is installed by factory-authorized personnel. This is important, for the retrofit market is estimated to be seven times larger than the OEM market.

The OEM market would continue to offer opportunity to large companies already dominating the heating/ventilating/air conditioning system market because they already make the refrigeration machinery that would be the heart of an OEM system with heat recovery. Retrofit systems, consisting of the heat exchanger and accessories, appear to remain in the bailiwick of many smaller businesses. But these smaller manufacturers could be overshadowed by the well-organized corporate sales campaigns of large OEM companies; more retrofit demonstration projects are needed to provide field experience data for appropriate marketing efforts.

Still, there is more **research and development needed to improve heat recovery technology.** While a double-wall heat exchanger may be one solution to the potable water contamination risk identified earlier, it is not an efficient technological approach and there is need for a fail-safe design with more heat transfer efficiency (EPRI-EM-1348/J V.1)

>>>>>>> With **mergers and acquisitions** occurring at what was once an unheard of pace, managers of **innovative organizations** need to be sensitive to the human impact of such a change. That impact is often a secondary consideration, and yet a case study by researchers at the University of Michigan Institute for Social Research reveals that employees at all levels of an organization can be affected, not just those who are fired or transferred.

Actually, those employees who were not direct targets were more likely to report that working conditions had changed after the acquisition. They were reacting to a ripple effect whereby the pressures on top managment were transmitted downward until they affected the overall work climate and employee morale.

In view of the growing number of mergers and acquisitions, top managers are urged to become better prepared for, and educated to, the possibilities of acquisition. Contingency plans should be prepared for responding to an attempted, and even to an eventual, takeover, and specific processes should be set in motion for managing the negotiations, execution, and impact of the acquisition.

Full **communication with employees** (within the constraints of legal requirements) is very important. "By not sharing information, management risks alienating employees who are left to rely on rumors and their own expectations; by holding back information that is seemingly unfavorable management risks creating more troubles and fears once the information becomes public; and by not providing truthful information, management risks creating further distrust and eventually greater turnover."

Critical to the success of the acquisition is the development of a mutual working relationship between the two parties. In light of the tensions that can be expected to arise, it might be wise to involve **behavioral science consultants** with expertise in managing inter-group conflicts.

Finally, managers are urged to recognize the inevitability of mistakes. In the event of an acquisition, they should, therefore, make an explicit commitment to try to learn from their mistakes and redirect their energies toward dealing with the new realities of the business. (PB81-118903/J)

>>>>>>> Innovations to improve aircraft performance, from such fast-moving fields as **microelectronics** and **advanced structural materials,** have also prompted concerns about how incorporation of these technologies increases **vulnerability of aircraft** to the **effects of atmospheric electricity.**

Airborne electronic and electrical systems that use microelectronic circuits operate at substantially lower power levels than previous systems and are more sensitive to transient overvoltage. Thus they are inherently susceptible to system upset or malfunction at the least, and to component burnout at the worst. This could be hazardous to the aircraft if the systems affected are critical to flight safety.

At the same time that overvoltage sensitivity has been increased by use of microelectronics, the possibility of overvoltage is also up because of the use of **composite structural materials** like graphite or boron-epoxy. These materials do not provide the same degree of electromagnetic shielding that is achieved with all-aluminum construction of conventional aircraft.

While there is a well-established technology to harden an aircraft against direct lightning strikes, advanced microelectronics need special hardening techniques against the **indirect effects of lightning-induced transients.** It is possible to minimize indirect effects by locating electronic equipment where the fields induced by lightning currents are lowest, which means putting the equipment as far as possible from such major apertures as access doors. These doors usually have imperfectly conducting covers and are a source of electromagnetic leakage. The "Catch 22" is that the purpose of such doors is to provide access to electronic equipment. In many cases a designer may not have much choice in the location of electronic equipment.

However, a designer may have more control over routing of wiring and can keep it away from apertures and where there is the smallest radius of curvature of structural members or of the outer skin. If the structural member can be trough-shaped, it will provide better shielding than if wiring is carried along its edge. A specialist in these problems, J. Anderson Plumer of Lightning Technolgies, Inc., offers some basic principles for protecting wiring against indirect effects:

- The closer a conductor is placed to a metallic ground plane, the less the flux passing between the conductor and ground plane.

- Magnetic fields are concentrated around protruding structural members and diverge in inside corners. Thus conductors on top of protruding members will intercept more magnetic flux than conductors placed inside corners where the field intensity is weaker.
- Fields will be weaker on the interior of a U-shaped member than they will be on the edges of that member.
- Fields will be lowest inside a closed member.

Protection through shielding requires more attention than simply choice of shield material. **Shielding against magnetic fields** requires the shield to be grounded at both ends in order that it may carry a circulating current. This current cancels the magnetic fields that produce common-mode voltages. Indeed, there is merit in grounding a shield at multiple points, since frequently a cable will be exposed to a significant amount of magnetic field over only a small portion of its total length.

Plumer also comments on **circuit design practices that can minimize induced effects.** Fundamentally, a device with a broad bandwidth can intercept more noise energy than one with a narrow bandwidth. Lightning-related noise interference comes from a broad frqeuency spectrum and may even be concentrated in certain frequency bands by the characteristic response of the aircraft or of the wiring within the aircraft. Studies of interference produced in aircraft by the flow of lightning current have shown that the lightning energy excites oscillatory frequencies in aircraft wiring, particularly if that wiring is based on a single-point ground concept. The characteristic frequencies in the wiring tend to be in the range of several hundred kilohertz to a few megahertz. Therefore, the passbands of electronic equipment should not include these frequencies. It should be noted that fiber optic signal transmission operating in the infrared region avoids the frequency spectrum associated with lightning-generated interference, making **fiber optic technology** particularly attractive for hardening against induced effects. (AD-A087 976/J)

>>>>>>> **Computed tomography**, in which an image is produced of a cross section slice through an object, has been applied to such diverse fields as **electron microscopy, radio astronomy** and, most notably, **medicine.** Now, researchers at Los Alamos Scientific Laboratory believe it could also serve as a tool for **industrial inspection** and **nondestructive testing.**

Tomography offers the advantage, for industrial applications, of a large difference in attenuation coefficient between various materials. For instance, air surrounded by heavy metal is much easier to detect with fewer penetrating photons than tissue types with similar attenuation coefficients. Consequently, these high-attenuation differentials can make defects detectable with comparatively rapid but high-resolution scans using a properly collimated **solid state detector.**

Although various performance tradeoffs could limit the industrial applicability of computed tomography, the Los Alamos investigators believe this limitation can be overcome. Through experimentation and **computer simulation,** one can choose an optimal source intensity, energy range, and matching detector medium. Simulation will then determine the image quality that can be expected, as well as the time required for gathering the necessary projections.

Computer simulations, which have been used to model proposed tomographic hardware configurations, indicate that **neutron tomography** can differentiate fissionable materials. This means that it may be possible to make nondestructive quantitative **assays of sealed radioactive containers.**

Under certain conditions, film can be used in place of electronic detectors. **Film-based tomography** has been demonstrated for **detecting and sizing cracks in nuclear reactor cooling tubes.** (LA-8412-MS/J)

To Dig Deeper: A Published Search contains 156 bibliographic citations on **computerized axial tomography.** (PB81-804528/J)

Another NTIS Published Search contains 214 bibliographic citations on **computerized axial tomography** from the **Engineering Index.** (PB81-804536/J)

>>>>>>> Technology development to safeguard nuclear plants against unauthorized access is providing interesting fallout for **security** in industrial plants and other areas that must be guarded and where the movement of personnel must be carefully monitored.

An advanced **access control system** being developed at the Barnwell nuclear fuel plant is concerned with combining positive identification of personnel and automated access control at all interior control points. The system is based on commercially available hardware with additional prototype and developmental equipment where required.

The concept of the system is to provide double protection even though a person carries a card-key. A **voice verification system,** in this case a developmental model by Texas Instruments, compares a voice-print sample taken at an access control point with a reference file voice-print. This is not the only clearance, for a computer also searches the individual's access authorization file and an area status file to verify that person's authority for entering. Even the card-key gets changed, being randomly selected each time and then registered to the user upon initial entry to the general site. A proximity system made by Schlage Electronics, Inc., reads the card-key through several layers of clothing.

From the standpoint of operations and safety, the combination of voice verification and **card-key system** makes it possible to **locate specific individuals** as well as to provide **real-time personnel inventories** within all controlled portions of a facility. (AGNS-35900-CONF-67/J)

>>>>>>> **Radio voice quality in the presence of interference and fading** has been a long-standing problem with high-frequency single sideband radiotelephone equipment. While there are affordable solutions to this problem for commercial radiotelephone equipment used in the communications business, smaller users in other businesses had not been able to take advantage of this technology for their single sideband sets. Now new technology has been developed in Canada for both original equipment manufacture and for existing **radiotelephones.**

Intelligibility has been a problem with single sideband voice transmission because noise masks the low-level syllables. Technically, the means of overcoming this problem is to reduce the dynamic range of the transmitter so that all syllables can be transmitted at or near full power.

The new Canadian development is based on Lincompex, a well-established development of the British Post Office. Lincompex is not only expensive, but works well only with very stable radiotelephone sets where frequency offset, mis-alignment between transmitter and receiver, must be less than ± 2 Hz. Since Lincompex, there have been significant advances in **microprocessor technology** and in **large scale integrated circuits**, facilitating the Syncompex approach.

The Syncompex system consists of two variable gain audio amplifiers. One is a compressor that works with the transmitter to reduce the dynamic range of the voice signal. The other amplifier is an expander that works with the receiver to restore voice dynamics to their original form. A **digital control** signal defines the precise time at which the gain change in compression occurs. The digital nature of the control signal permits relative insensitivity to frequency offset, making possible a mis-alignment limit with Syncompex of ± 20 Hz. Thus the technology can be retrofitted to many radios now in service.

Tests of the Syncompex system were carried out in Canada over 40-mile and 700-mile ranges during periods of selective fading. There was a significant improvement in intelligibility and a corresponding reduction in factors contributing to **operator fatigue.** Because noise is silenced by Syncompex during speech pauses, the listener feels more confident that a low-level syllable has not been missed which could have dramatically changed the meaning of a sentence. Speech also sounds more natural because the control channel keeps the receiver gain from fluctuating during a speech pause. Syncompex voice processing is judged to be equivalent to about a 10 db increase in transmitter power. (N80-33648/J)

>>>>>>> **New instrumentation** on the way for **sampling and measuring particles** should lead to more accurate assessment of the effects of **pollution.** Instruments described at a recent symposium include:

- An automatic piezoelectric microbalance for concentration measurements on ambient **aerosols,** by Kagaku Kogyo Co., Japan. The prototype monitor is highly sensitive to mass concentration and can be operated unattended for weeks at a time.
- A prototype automatic isokinetic sampling probe with a unique sensor for **measuring particulate mass** in real time, by Sandia Laboratories and Rupprecht and Patashnick Co. Evaluation in a room-temperature wind tunnel has indicated good agreement between the particle feed rate to the tunnel and the particulate mass measured by the instrument.
- A commercially available instrument which **sizes particles** between 0.005 and 0.2 micrometers, by TSI, Inc. The instrument combines a diffusion battery with an automatic valve and a condensation nucleus counter to automatically measure a size distribution in approximately 4 minutes. It can operate over a range of particle concentrations from less than $1/cm^3$ to more than $10^6/cm^3$ without a dilution system.
- A commercially available instrument uses a hot-wire technique to provide in situ **sizing of liquid droplets** in the 1-to-66 micrometer range, by KLD Associates, Inc. The instrument has been used to evaluate the performance of demisters on **limestone scrubbers** for desulfurization of electric power plant flue gas, and to **measure** entrained droplets in quenching **towers and oil** mist in a manufacturing process. (PB81-118432/J)

>>>>>>> Greater use of product **performance standards** has been proposed as a means of **increasing innovation** in **automobile manufacturing, construction, health care,** and other fields. However, there remains opposition to the replacement of traditional **design or prescriptive standards** with performance standards. When Harvard University economist David Hemenway examined the pros and cons, he came to the following conclusions:

- The two types of standard complement one another, they are not substitutes. For instance, performance standards can include design specifications as examples of current state-of-the-art methods of meeting the performance criteria.
- Performance standards are more than equivalency statements. They are useful for organizing thinking. And whereas design or construction standards are more likely to promote price-fixing conspiracies and exclude new and existing products, performance standards should encourage **competition and innovation.**
- Nevertheless, performance standards are not panaceas:
    1. It is possible to write poor performance standards.
    2. Like all standards, they are restrictive. (It can be useful to consider any performance standard as a part of a hierarchy, from the general to the more specific and restrictive.)
    3. Performance standards do not eliminate the problem of determining proper quality levels.
    4. Decisions must still be made whether or not to permit trade-offs among quality components.

Writing performance standards and creating reliable test methods is difficult and costly. There are also **incentive problems** that stand in the way of using performance standards. For example, some groups, such as established firms that are not especially innovative and do not wish to lose market share, benefit from design standards. They may not only refuse to promote performance standards but may actually impede their creation.

From the regulators' viewpoint, performance standards may increase enforcement costs, and the institutional mechanisms for evaluating new products may not be adequate.

In some areas, design standards may be preferable to performance standards. These include **testing standards,** where the need for comparability usually outweighs the possible benefits from encouraging innovation, and **safety standards,** if risks are large and laboratory tests are not completely reliable predictors of product performance. (PB81-120362/J)

>>>>>>> Conventional **electron-beam technology,** widely used for **welding** and **heat treatment,** is limited in the area it can cover easily. However, the University of Connecticut's Institute of Materials Science has constructed a special wave form generator for its Zeiss electron-beam unit that permits rapidly scanning a surface by electromagnetically deflecting the beam. In this way, thin surface layers of tool steel can be melted and a given set of quenching conditions imposed quickly and evenly over several square centimeters of steel.

Electron-beam glazing is expected to make a significant contribution to the heat treatment of **machine tool** cutting edges and bearing surfaces. Tests are underway to confirm its usefulness in modifying and controlling surface microstructures. *Such modifications* are expected to improve both **wear** and **corrosion** properties, as well as to increase **hardness, fracture toughness,** and other mechanical properties.

Surface chemical refinement is a more speculative application for the area glazing technique. Experiments have revealed that surface impurities and below-surface defects can be wiped away by the surface glaze. Thus, there is a possibility of cleaning, for example, the inner surface of **ball races** in **gas turbine engines** where surface inclusions are a major problem. With surface temperatures approaching the vaporization temperature of iron, some degree of "refining" seems possible at the surfaces of many materials. (AD-A089 631/J)

>>>>>>> The frontiers of **high-temperature electronics and instrumentation** technology are moving beyond the conventional 125°C boundary into regions required for **oil and gas well logging, geothermal logging,** and **jet engine** and **nuclear reactor monitoring.** Among the highlights of a seminar on the subject:

- Custom **hybrid circuits** are commercially available for 200°C operation; special customer circuits for 300°C operation should be coming on the market shortly.
- **Silicon integrated circuits** are now available for 200°C; operational amplifiers and some digital circuits should be available within a few years for use up to 300°C. (Silicon devices do not appear to reach "fundamental" limits until 325-375°C.)
- A number of **elastomers** warrant serious consideration for high-temperature downhole use, including selected ethylene/propylene rubber formulations, fluoroelastomers and perfluoroelastomers. The latter class, represented by Du Pont's Kalrez, is the most thermally stable of the group. It has been used successfully in logging cablehead insulator boots, tubing seals, and o-ring seals. (**Elastomeric seals** often fail at high temperatures under stress because of extrusion and loss of mechanical strength.)
- **Acoustic sensors** look promising for **borehole measurements** of temperature, pressure and flow. **Packaging,** however, is a major limitation on field use, and considerable work is needed on all aspects of **materials research for transducers** which must function at temperatures between 250 and 500°C.
- **Slickline systems** for measuring temperature and pressure up to 260°C are standard products, and systems for above 350°C should be on the market soon. The greatest problems are in the clocks, tool seals, and high-temperature material for Bourdon tubes.
- A **wireline wellhead system** has been developed by Bowen Tool Co. for use to 260°C. The wellhead's blowout preventor seals are made from **fluoroelastomers** and TFE Teflon by Du Pont. (SAND-80-0834C/J)

>>>>>>> Combinations of problems that may emerge from shale oil development efforts may lead to unique **environmental control system requirements.** Impact on health of various **shale oil technologies** is being explored now by a Department of Energy Oil Shale Task Force so that cost considerations for environmental controls can be factored in before large-scale utilization of oil recovery technology.

Each shale oil recovery process has a distinct technology which, in some cases, offers unique occupational health considerations requiring site and technology-specific biological/toxicological experimentation. Shale oil comes *from a solid fossil* substance called kerogen which is embedded in sedimentary rock. Oil shale is a fine-grained, thinly layered mixture of dolomite, calcium, quartz and clays.

Most recovery processes under consideration at present require underground mining. Miners would be exposed to dust, so its suppression will be a requirement during mining operations. Dust may still be a problem above ground since most retorting methods involve crushing and grading shale. Kerogen does not readily flow out of rock at ordinary temperatures, so fragments are heated to about 900°F in free-standing retorts (chimney-like vessels). The vapors that are released are condensed to recover shale oil, though the kerogen also breaks down into combustible hydrocarbon gases and black carbon residue.

Actually there are many variations of processing procedures and a wide range of **retorting conditions** may be encountered, each of which may require its own environmental control technology once the health hazards have been determined. For example, a team from Los Alamos Scientific Laboratory studied one mine where a gas combustion retort had a vertical kiln. Coarsely crushed shale moves downward in this kiln while gas and vapors flow upward. During the operation of this retort, the team detected a strong odor of nitrogen bases downwind. Nitrogen bases are nitrogen compounds which can be extracted from an oil mixture by means of strong mineral acids and consist of homologues of pyridine, pyrole, quinoline, acridine and similar heterocyclic nitrogen compounds. These are somewhat irritating to the respiratory system. More importantly, little is yet known about the **toxicity** of these materials so no occupational health standards have been established.

What's more, **underground recovery processes** are now under experimentation. The in situ method uses the earth itself as a retort with the retorting vessel simply a receptacle blasted in the rock. The resultant rubble fragments are heated where they have accumulated. Some of the retorts thus carved rise from a base as broad as a football field to the height of a 30-story building. But all of this is underground, of course, and extensive underground mining and in situ recovery operations would consist of simultaneous, though different, processes, each with technology-specific environmental control requirements. Retorts may be carved and blasted even while others are burning with combustion gases and still others are filled with recovery products in the cooling phase. The trouble is that there is only limited experience with simultaneous operations and most oil shale recovery processes that have been demonstrated may not be typical of a scaled-up, fully mature industry. (LA-UR-80-876/J)

To Dig Deeper: An NTIS Published Search on **Oil Shale Mining, Processing, Uses and Environmental Impacts** offers 269 citations from the data base of the American Petroleum Institute. (PB80-813181/J)

Another NTIS Published Search **on oil shale technology** gives 206 citations from the NTIS database in the most recent search of its own collection. (PB80-810351/J)

The most recent NTIS Published Search of the Engineering Index covers **environmental impacts of oil shale mining and processing** with 178 citations. (PB80-810369/J)

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Reports referenced in this issue are grouped on this page in their order of appearance. If you receive the **Innovators Source Library** with each issue, you can immediately read in microfiche, all the reports—plus selected Published Searches (bibliographies). The reports and searches may be ordered in paper copy or microform using the short title order form on the opposite page. Price codes for paper copy (PC) and microfiche (MF) copies are listed in each citation for each report. To translate price codes to dollars, see Price Schedule on back cover. For additional information, write to **Information for Innovators,** National Technical Information Service, Springfield, VA 22161.

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Mr. WALGREN. The next witness is Senator Harrison Schmitt, whose timing is wonderful.

Welcome to the committee, Senator Schmitt.

As most of you in this room know, Senator Schmitt has—from his background with the National Aeronautics and Space Administration, and particularly the Apollo program—as a lunar module pilot—a broad background, and a very deep personal interest and commitment to the development of scientific technology and innovation in our society.

Senator Schmitt was a NASA administrator for energy programs, and served in a number of capacities with the NASA organization. He now serves on the Appropriations Committee; the Banking, Housing, and Urban Affairs Committee; the Commerce, Science, and Transportation Committee; and the Select Committee on Intelligence in the U.S. Senate.

We are very pleased that you could come over and spend some time with us, and share some of your perspectives on where we have to go if we are to maximize the contribution that the leading edge of science can make to our society and our economy in general.

Any written statement you have will, of course, be made part of the record, and please share your views as you see fit.

[The biographical sketch of Senator Schmitt follows:]

Senator Harrison Schmitt

Biographical Sketch

Harrison H. Schmitt was born in Santa Rita, New Mexico on July 3, 1935, and raised in Silver City, New Mexico. He was educated in the public schools of Silver City where he graduated from Western High School. He received a Bachelor of Science Degree from the California Institute of Technology in 1957, and he studied at the University of Oslo under a Fulbright fellowship during 1957 and 1958. Schmitt earned a Doctorate in Geology from Harvard University in 1964.

After graduating from Harvard, Schmitt spent a year working on space-related projects for the U.S. Geological Survey in Flagstaff, Arizona.

In 1965, Schmitt joined the NASA Apollo program. As the lunar module pilot and geologist of Apollo 17, Schmitt landed on the moon in the Valley of Taurus-Littrow in 1972.

Schmitt was appointed NASA Assistant Administrator for Energy Programs in May, 1974. He resigned from this post in August 1975 and returned to New Mexico to enter the senatorial race. Schmitt was elected to the United States Senate as a Republican on November 2, 1976.

Schmitt serves on the Appropriations Committee, the Banking, Housing and Urban Affairs Committee, the Commerce, Science, and Transportation Committee and the Select Committee on Intelligence.

Schmitt is a member of various scientific and professional organizations. He is the recipient of numerous professional and academic awards.

TESTIMONY OF HON. HARRISON H. SCHMITT, U.S. SENATOR FROM THE STATE OF NEW MEXICO

Senator **Schmitt**. Thank you, Mr. Chairman. I would ask your consent to include my entire statement in the record.

As you are well aware, and as the subcommittee is well aware, if you look back in the history of the United States and find where our major historical milestones are, many of them, if not most, represent a gradual or very quick breakthrough in science and technology. Certainly, the transcontinental railroad was one such breakthrough; the Panama Canal represented another; the agricultural revolution, which spanned decades of time, was another, and is one which is continuing—maybe not as fast as it should, but still is continuing.

The Apollo program, the nuclear program, all of these represent major historical milestones in the progress of this country; and all of them, in one way or another, resulted in a significant increase in the well-being of our citizens.

There have been mistakes made. We hope that we learned from those mistakes, and that we will not repeat them, and that we will become not just more cautious, but more aggressive simultaneously.

As long as I have been in the Congress, Mr. Chairman, one of my major interests has been how this Nation can capitalize more successfully on its science and technology base, as it exists now, and how it can expand that base in reasonable and energetic ways. These enterprises represent the critical marginal advantage on which our economic competitiveness, our national security and well-being depend.

The realization has spread rapidly in recent years that we can no longer take for granted the scientific and technological advantages which we enjoyed, relatively unchallenged, for much of the post-World War II period; and, in many respects, unchallenged for most of our history.

We now recognize, as examples, that:

The growth in our productivity lags behind that of most of the other industrialized nations;

Our educational system yields proportionally fewer scientists and engineers than many of our competitors, such as Japan and the U.S.S.R.;

The shortfall in holders of advanced degrees now approaches 15,000 per year, relative to our needs;

Our national literacy in mathematics and science and economics has deteriorated, even though our society is more extensively based than any other on science and technology;

Our universities and industries have become generally isolated from one another, although some positive trends have occurred in the last few months. In part, this isolation has resulted because of direct Federal support of academic research, which has displaced that which formerly came from industry and various foundations.

Our national laboratories have emerged as major centers of research and development, for which there are few mechanisms for transferring the technology to the private industrial and commercial sectors.

The exception to this has always been in the aeronautical field where, because of the way the laboratories and the technology development were institutionalized, it caused the private sector to be an important and continuing partner in the development of technology and in its transfer.

Senator Stevenson, my predecessor as chairman of the Subcommittee on Science, Technology and Space, and I have shared basic concerns about the availability of new technology in the private sector, and held a series of hearings on the subject in the 96th Congress. A result of these efforts, of course, was Public Law 96-480, the Stevenson-Wydler Technology Innovation Act of 1980.

Those hearings, as well as hearings in the House of Representatives, gave us a basic fundamental statement on this issue. The act provides a variety of mechanisms to stimulate scientific and technical exchanges and interactions among industry, academia, and the Federal laboratories, and to increase the utilization of federally funded technological developments by State and local governments.

Section 11 of that act, which addresses the responsibilities of the national laboratories for utilization of Federal technology, is of particular interest to me.

And, Mr. Chairman, I would like to correct the term "Federal" technology. The technology really isn't Federal; almost all of it lies, one way or another, within the private sector, as well as within the Federal sector. The only exceptions to that really are the national laboratories devoted to nuclear research. And, of course, much of that technology, being classified, has an even more difficult pathway into the private sector.

Two of our major national laboratories, Sandia and Los Alamos, are in my home State of New Mexico, and I am very pleased that they were active in technology transfer well before the passage of Stevenson-Wydler.

As my distinguished colleague, Mr. Skeen, recognizes, these two laboratories represent a tremendous reservoir of information and of technology, as yet largely untapped by the private sector.

Dr. Eugene Stark, industry liaison officer for the Los Alamos National Laboratories, is now Chairman of the Federal Laboratory Consortium for Technology Transfer. The laboratories of the consortium represent an enormous network of scientific and technical expertise in more than 200 Federal research and development laboratories and centers from 11 Federal agencies. Dr. Stark has briefed me and will be testifying before you on the achievements and plans which have been made by the consortium.

This hearing gives me a welcome opportunity, Mr. Chairman, to draw your attention and the attention of the subcommittee to an event which I believe is an ambitious and assertive example of the cooperative effort intended in section 11 and the rest of the Technology Innovation Act. And I would invite you to participate in the event if you possibly can do so.

Following through on a suggestion which I made several months ago in response to some activities sponsored by Senator Mathias over in Maryland, a number of the universities and Federal laboratories in New Mexico are collaborating to present the Showcase for Technology, which will be held in Albuquerque, October 28 through 30.

The Federal Government funds more than 1 billion dollars' worth of research and development in New Mexico each year. The knowledge and technology resulting from this R. & D. represent a very valuable national asset and the main goal of the Showcase for Technology is to share that wealth, to find ways of transferring the technology to industry.

I am pleased to note that the sponsors of the showcase are the U.S. Department of Energy, the Los Alamos National Laboratory, the Federal Laboratory Consortium, and Sandia National Laboratories.

Participating organizations include the University of New Mexico, New Mexico State University, New Mexico Institute of Mining and Technology, Air Force Weapons Laboratory, and White Sands Missile Range.

Responses from industry, not only in the Southwest but from all parts of the country, Government, and the academic world, have exceeded all of our expectations. There is no doubt in my mind that these responses are a valid indication that the concerns which led us to propose the Technology Innovation Act and its goals for effecting the interaction and transfer of technology among the Federal laboratories, the universities, industry, and the State and the local governments are widely recognized and accepted in the Nation as a whole.

I hope that you can accept my invitation to join us at the Showcase for Technology and participate in this ambitious effort to further the intent of Stevenson-Wydler.

Now, let me address the overall implementation to date of the Technology Innovation Act. We recognized, at the time of its proposal, that the legislation was not a comprehensive or complete approach to the challenge of technology transfer in this country.

A number of other factors, such as restrictions on transfer of patent rights for government-sponsored technology and a tax structure which discourages investment in R. & D. are equally or more important to fostering a dynamically creative climate for capitalizing on the results of science and technology.

I should add here, Mr. Chairman, that had the last administration been receptive to a broader technology act, Senator Stevenson and I would have proposed a broader fundamental act. But unfortunately we did not have the support then as members of this committee recall.

However, the Technology Innovation Act was considered a useful and achievable effort at the time of its passage.

There now is a new administration, with very different ideas about how to stimulate our economy and insure our national security, as well as on the appropriate role of Government in promoting innovation and productivity. Greater emphasis is being given to incentives like lowering taxes, reducing unnecessary regulation, providing tax credits for R. & D., and offering broader assignment of patent rights for Government-funded research.

There is less inclination to direct Government participation in the process of innovation and technology transfer. In general, I agree with this approach as the most effective way to help get our economy going again, although I do believe that each of the agencies of Government has a specific responsibility to make the transfer of technology as easy and as direct a process as possible.

This administration's approach to implementing Stevenson-Wydler will expectedly be different from that of its predecessor. The Department of Commerce has already testified before you on what approach it will take as lead agency under the act.

Representatives of the National Science Foundation and the Federal Laboratory Consortium for Technology Transfer will testify later. But many of the responsible agency officials have only recently assumed their postions; some have not yet been confirmed, some have not yet been appointed.

Budgetary constraints on the agencies are likely to be greater than were anticipated last year and may, for example, make more difficult the realization of the provisions of section 11(b) for agencies to "make available not less than 0.5 percent of the agency's research and development budget to support the technology transfer function at the agency and its laboratories."

Nevertheless, there are some promising signs. I understand that essentially all of the agencies have established an office of research and technology applications as required under section 11(b).

Further, most of the agencies have, or will assign, a professional person as full-time staff for the technology transfer function.

These actions may well be better indicators of agency commitment than the 0.5 percent of R. & D. budget set-aside. Some agencies have indicated that they are already investing in excess of the 0.5-percent level. Others, even where full-time professional staff are in place, feel that they could not use that much money effectively if it were available.

Dr. Stark will be able to talk to this issue in greater detail when he testifies before you later. We recognize that while the proposal for the act was being considered, that the 0.5-percent level was a rough benchmark, which would have to be examined later by Congress once the program had been in operation for a period of time.

Mr. Chairman, section 6(e) addresses another important factor in the utilization of federally-supported research and development. This section provides a qualified option under which centers for industrial technology can acquire "Title to any invention conceived or made under the auspices of the center that was supported, at least in part, by Federal funds."

It is not clear that the nonprofit or university-affiliated centers will be realized, so that the prospects for implementation of section 6(e) are unclear.

However, in combination with the passage of the Small Business and University Patent Policy Act of last year, we may be making some significant progress along this line. I am very supportive of the principle that those who perform research and development with support from the Federal Government and who are willing to take the risk of commercializing the results of that research and development, should have a clear chance to do so.

In the past, the policies among Federal agencies have varied widely regarding assignment of rights to inventions which resulted from federally-supported research and development. I have supported efforts to establish a uniform policy which follows that articulated in section 6(e).

I must also say the members of this Science and Technology Subcommittee in the House have been moving along roughly the same lines, and the cooperation to date has been outstanding.

Last year the University and Small Business Patent Procedures Act, Public Law 96-517, which I mentioned previously, was enacted and provides for uniform assignment of patent rights to qualified universities, nonprofit organizations, and small businesses.

Regulations for implementation of Public Law 96-517 have just been issued for comment by the Office of Federal Procurement Policy.

In the 96th Congress, the Committee on Commerce, Science, and Transportation held hearings on S. 1215, the Uniform Science and Technology Research and Development Utilization Act, which I sponsored. This year I intend to reintroduce this legislation, which would provide for all performers of federally supported research and development a uniform Federal policy with respect to the ownership of inventions. Such a policy is both timely and consistent with the administration's emphasis on the responsibilities of the private sector for providing and commercializing technological innovation in this country.

We will be holding hearings on the subject on July 28, and I believe that joint hearings between our two committees will be scheduled soon thereafter. We had hoped that the first hearing would be joint, but apparently schedules do not permit.

There are also signs that universities, industries, and Government are moving on their own to collaborate on technology innovation and transfer.

The business school at the University of New Mexico has offered a course in technological entrepreneurship taught by Prof. Ray Radosevich, in which students actually work with inventor-entrepreneurs in the State to develop plans for commercialization of their ideas, as well as toward transfer technology. The results so far suggest that two or three projects will lead to successful product commercialization.

And, as I understand it, the students in the business school are moving out into the private sector with the technology that they have worked with in the transfer process. It's an exciting and innovative process which I commend to the committee. Maybe at some later time we might invite a group in to discuss how they're tying the business transfer and the technology transfer together and working simultaneously.

Another example though has so far been a victim of its own success. The University of New Mexico established the technology innovation program to provide, on a broader scale, the assistance which Professor Radosevich's students provide in their class projects.

A request for funding was submitted to the State legislature, where the response was very receptive across the board. Apparently, however, the response was so receptive that agreement could not be reached on who would sponsor the request, who would get credit for it, and it subsequently died.

We've got to be very careful about being too successful in a political environment, I guess. The irony of these events would be amusing if it were not for the important service which was lost, or at least delayed, in the process.

Nevertheless, my major point remains—universities, industries, and government are realizing more and more that and how they relate to one another in promoting and capitalizing on innovation. My examples all came from New Mexico, but I am sure that every State has had comparable experiences that suggest that the intent of Stevenson-Wydler is being realized even before full implementation of the legislation has been undertaken by the administration.

Summing up then, it seems that the act is being implemented, albeit more slowly and less comprehensively than had been expected. At the same time, there is a new administration which has had to install new agency management teams; this process has proceeded more slowly than we would have anticipated.

Perhaps most important are the quite different plans of this administration for stimulating our economy. These plans rely on strategies which differ from and may in some instances preclude some of those provided under the act.

It is probably too early to judge the progress of the administration's strategies or its implementation of the Technology Innovation Act. However, by this fall an assessment of the progress should be in order, and I would hope the administration would assist us in that assessment and give us a very clear indication of how they intend to proceed from that point.

At that time, my Subcommittee of Science and Technology and Space intends to hold hearings which should complement your findings in these hearings over the next few days, and I think it would be appropriate to consider again a joint hearing environment since this has been clearly a bipartisan, a bicameral effort on the part of the Congress.

I appreciate this opportunity to appear before you, and I will be happy to answer any questions, should time permit.

[The prepared statement of Senator Schmitt follows:]

STATEMENT OF
SENATOR HARRISON H. SCHMITT
CHAIRMAN OF THE SCIENCE, TECHNOLOGY AND SPACE SUBCOMMITTEE OF THE SENTATE COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY OF THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

JULY 14, 1981

AS LONG AS I HAVE BEEN IN THE CONGRESS ONE OF MY MAJOR INTERESTS HAS BEEN HOW THIS NATION CAN CAPITALIZE MORE SUCCESSFULLY ON ITS SCIENCE AND TECHNOLOGY. THESE ENTERPRISES REPRESENT THE CRITICAL MARGINAL ADVANTAGE ON WHICH OUR ECONOMIC COMPETITIVENESS, OUR NATIONAL SECURITY AND WELL BEING DEPEND.

THE REALIZATION HAS SPREAD RAPIDLY IN RECENT YEARS THAT WE CAN NO LONGER TAKE FOR GRANTED THE SCIENTIFIC AND TECHNOLOGICAL ADVANTAGES WHICH WE ENJOYED RELATIVELY UNCHALLENGED FOR MUCH OF THE POST-WORLD WAR II PERIOD. WE NOW RECOGNIZE THAT, AS EXAMPLES,

- o THE GROWTH IN OUR PRODUCTIVITY LAGS THAT OF MOST OF THE OTHER INDUSTRIALIZED NATIONS
- o OUR EDUCATIONAL SYSTEM YIELDS PROPORTIONALLY FEWER SCIENTISTS AND ENGINEERS THAN MANY OF OUR COMPETITORS, SUCH AS JAPAN AND THE U.S.S.R.
- o OUR NATIONAL LITERACY IN MATHEMATICS AND SCIENCE HAS DETERIORATED, EVEN THOUGH OUR SOCIETY IS MORE EXTENSIVELY BASED THAN ANY OTHER ON SCIENCE AND TECHNOLOGY

- OUR UNIVERSITIES AND INDUSTRIES HAVE BECOME GENERALLY ISOLATED FROM ONE ANOTHER, IN PART BECAUSE DIRECT FEDERAL SUPPORT OF ACADEMIC RESEARCH HAS DISPLACED THAT WHICH FORMERLY CAME FROM INDUSTRY
- OUR NATIONAL LABORATORIES HAVE EMERGED AS MAJOR CENTERS OF RESEARCH AND DEVELOPMENT, FOR WHICH THERE ARE FEW MECHANISMS FOR TRANSFERRING THE TECHNOLOGY TO THE PRIVATE INDUSTRIAL AND COMMERCIAL SECTORS.

SENATOR STEVENSON, MY PREDECESSOR AS CHAIRMAN OF THE SUBCOMMITTEE ON SCIENCE, TECHNOLOGY AND SPACE, AND I SHARED BASIC CONCERNS ABOUT THE AVAILABILITY OF NEW TECHNOLOGY IN THE PRIVATE SECTOR AND HELD A SERIES OF HEARINGS ON THE SUBJECT IN THE 96TH CONGRESS. A RESULT OF THESE EFFORTS WAS, OF COURSE, P. L. 96-480, THE "STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980". THE ACT PROVIDES A VARIETY OF MECHANISMS TO STIMULATE SCIENTIFIC AND TECHNICAL EXCHANGES AND INTERACTIONS AMONG INDUSTRY, ACADEMIA AND THE FEDERAL LABORATORIES AND TO INCREASE THE UTILIZATION OF FEDERALLY FUNDED TECHNOLOGICAL DEVELOPMENTS BY STATE AND LOCAL GOVERNMENTS.

SECTION 11, WHICH ADDRESSES THE RESPONSIBILITIES OF THE NATIONAL LABORATORIES FOR UTILIZATION OF FEDERAL TECHNOLOGY, IS OF PARTICULAR INTEREST TO ME. TWO OF OUR MAJOR NATIONAL LABORATORIES, SANDIA AND LOS ALAMOS, ARE IN MY HOME STATE OF NEW MEXICO, AND I AM VERY PLEASED THAT THEY WERE ACTIVE IN

TECHNOLOGY TRANSFER WELL BEFORE THE PASSAGE OF STEVENSON-WYDLER. DR. EUGENE STARK, INDUSTRY LIAISON OFFICER FOR THE LOS ALAMOS NATIONAL LABORATORIES, IS NOW CHAIRMAN OF THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER. THE LABORATORIES OF THE CONSORTIUM REPRESENT AN ENORMOUS NETWORK OF SCIENTIFIC AND TECHNICAL EXPERTISE IN MORE THAN 200 FEDERAL RESEARCH AND DEVELOPMENT LABORATORIES AND CENTERS FROM 11 FEDERAL AGENCIES. DR. STARK HAS BRIEFED ME AND WILL BE TESTIFYING BEFORE YOU ON THE ACHIEVEMENTS AND PLANS WHICH HAVE BEEN MADE BY THE CONSORTIUM.

THIS HEARING GIVES ME A WELCOME OPPORTUNITY TO DRAW ATTENTION AND INVITE YOU TO AN EVENT WHICH I BELIEVE IS AN AMBITIOUS AND ASSERTIVE EXAMPLE OF THE COOPERATIVE EFFORT INTENDED IN SECTION 11 AND THE REST OF THE TECHNOLOGY INNOVATION ACT. FOLLOWING THROUGH ON A SUGGESTION WHICH I MADE SEVERAL MONTHS AGO, A NUMBER OF THE UNIVERSITIES AND THE FEDERAL LABORATORIES IN NEW MEXICO ARE COLLABORATING TO PRESENT THE "SHOWCASE FOR TECHNOLOGY" , WHICH WILL BE HELD IN ALBUQUERQUE, OCTOBER 28 THROUGH 30.

THE FEDERAL GOVERNMENT FUNDS MORE THAN A BILLION DOLLARS WORTH OF RESEARCH AND DEVELOPMENT IN NEW MEXICO EACH YEAR. THE KNOWLEDGE AND TECHNOLOGY RESULTING FROM THIS R AND D REPRESENTS A VERY VALUABLE NATIONAL ASSET, AND THE MAIN GOAL OF THE SHOWCASE FOR TECHNOLOGY IS TO SHARE THAT WEALTH, TO FIND WAYS OF TRANSFERRING THE TECHNOLOGY TO INDUSTRY.

I AM PLEASED TO NOTE THAT THE SPONSORS OF THE SHOWCASE ARE THE U. S. DEPARTMENT OF ENERGY, THE LOS ALAMOS NATIONAL LABORATORY, THE FEDERAL LABORATORY CONSORTIUM, AND SANDIA NATIONAL LABORATORIES. PARTICIPATING ORGANIZATIONS INCLUDE THE UNIVERSITY OF NEW MEXICO, NEW MEXICO STATE UNIVERSITY, NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY, AIR FORCE WEAPONS LABORATORY, AND WHITE SANDS MISSILE RANGE.

RESPONSES FROM INDUSTRY, NOT ONLY IN THE SOUTHWEST BUT FROM ALL PARTS OF THE COUNTRY, GOVERNMENT AND THE ACADEMIC WORLD HAVE EXCEEDED ALL OF OUR EXPECTATIONS. THERE IS NO DOUBT IN MY MIND THAT THESE RESPONSES ARE A VALID INDICATION THAT THE CONCERNS WHICH LED US TO PROPOSE THE TECHNOLOGY INNOVATION ACT AND ITS GOALS FOR EFFECTING THE INTERACTION AND TRANSFER OF TECHNOLOGY AMONG THE FEDERAL LABORATORIES, THE UNIVERSITIES, INDUSTRY AND STATE AND LOCAL GOVERNMENTS ARE WIDELY RECOGNIZED AND ACCEPTED. I HOPE THAT YOU CAN ACCEPT MY INVITATION TO JOIN US AT THE SHOWCASE FOR TECHNOLOGY AND PARTICIPATE IN THIS AMBITIOUS EFFORT TO FURTHER THE INTENT OF STEVENSON-WYDLER.

LET ME ADDRESS NOW THE OVER-ALL IMPLEMENTATION TO DATE OF THE TECHNOLOGY INNOVATION ACT. WE RECOGNIZED AT THE TIME OF ITS PROPOSAL, THAT THE LEGISLATION WAS NOT A COMPREHENSIVE OR COMPLETE APPROACH TO THE CHALLENGE OF TECHNOLOGY TRANSFER IN THIS COUNTRY. A NUMBER OF OTHER FACTORS, SUCH AS RESTRICTIONS ON TRANSFER OF PATENT RIGHTS FOR GOVERNMENT-SPONSORED TECHNOLOGY, AND A TAX STRUCTURE WHICH DISCOURAGES INVESTMENT IN R AND D, ARE EQUALLY OR MORE IMPORTANT TO FOSTERING A DYNAMICALLY CREATIVE CLIMATE FOR CAPITALIZING ON THE RESULTS OF SCIENCE AND TECHNOLOGY. HOWEVER THE TECHNOLOGY INNOVATION ACT WAS CONSIDERED A USEFUL AND ACHIEVEABLE EFFORT AT THE TIME OF ITS PASSAGE.

NOW THERE IS A NEW ADMINISTRATION WITH VERY DIFFERENT IDEAS ABOUT HOW TO STIMULATE OUR ECONOMY AND ASSURE OUR NATIONAL SECURITY, AS WELL AS ON THE APPROPRIATE ROLE OF GOVERNMENT IN PROMOTING INNOVATION AND PRODUCTIVITY. GREATER EMPHASIS IS BEING GIVEN TO INCENTIVES LIKE LOWERING TAXES, REDUCING UNNECESSARY REGULATION, PROVIDING TAX CREDITS FOR R AND D AND OFFERING BROADER ASSIGNMENT OF PATENT RIGHTS FOR GOVERNMENT FUNDED RESEARCH.

THERE IS LESS INCLINATION TO DIRECT GOVERNMENT PARTICIPATION IN THE PROCESS OF INNOVATION AND TECHNOLOGY TRANSFER. IN GENERAL I AGREE WITH THIS APPROACH AS THE MOST EFFECTIVE WAY TO HELP GET OUR ECONOMY GOING AGAIN.

THIS ADMINISTRATION'S APPROACH TO IMPLEMENTING STEVENSON-WYDLER WILL EXPECTEDLY BE DIFFERENT FROM THAT OF ITS PREDECESSOR. THE DEPARTMENT OF COMMERCE HAS ALREADY TESTIFIED BEFORE YOU ON WHAT APPROACH IT WILL TAKE AS LEAD AGENCY UNDER THE ACT. REPRESENTATIVES OF THE NATIONAL SCIENCE FOUNDATION AND THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER WILL TESTIFY LATER. MANY OF THE RESPONSIBLE AGENCY OFFICIALS HAVE ONLY RECENTLY ASSUMED THEIR POSITIONS: SOME HAVE NOT YET BEEN

APPOINTED.

BUDGETARY CONSTRAINTS ON THE AGENCIES ARE LIKELY TO BE GREATER ON THE AGENCIES THAN WERE ANTICIPATED LAST YEAR AND MAY, FOR EXAMPLE, MAKE MORE DIFFICULT THE REALIZATION OF THE PROVISION OF SECTION 11(b) FOR AGENCIES TO "...MAKE AVAILABLE NOT LESS THAN 0.5 PERCENT OF THE AGENCY'S RESEARCH AND DEVELOPMENT BUDGET TO SUPPORT THE TECHNOLOGY TRANSFER FUNCTION AT THE AGENCY AND AT ITS LABORATORIES, ..."

NEVERTHELESS, THERE ARE SOME PROMISING SIGNS. I UNDERSTAND THAT ESSENTIALLY ALL OF THE AGENCIES HAVE ESTABLISHED AN OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS AS REQUIRED UNDER SECTION 11(b). FURTHER, MOST OF THE AGENCIES HAVE OR WILL ASSIGN A PROFESSIONAL PERSON AS FULL TIME STAFF FOR THE TECHNOLOGY TRANSFER FUNCTION.

THESE ACTIONS MAY WELL BE BETTER INDICATORS OF AGENCY COMMITMENT THAN THE 0.5 PERCENT OF R AND D BUDGET SET-ASIDE. SOME AGENCIES HAVE INDICATED THAT THEY ARE ALREADY INVESTING IN EXCESS OF THE 0.5 PERCENT LEVEL. OTHERS, EVEN WHERE FULL TIME PROFESSIONAL STAFF ARE IN PLACE, FEEL THAT THEY COULD NOT USE THAT MUCH MONEY EFFECTIVELY IF IT WERE AVAILABLE. DR. STARK WILL BE ABLE TO TALK TO THIS ISSUE IN GREATER DETAIL WHEN HE TESTIFIES BEFORE YOU LATER. WE RECOGNIZED WHILE THE PROPOSAL FOR THE ACT WAS BEING CONSIDERED THAT THE 0.5 PERCENT LEVEL WAS A ROUGH BENCHMARK, WHICH WOULD HAVE TO BE EXAMINED LATER BY CONGRESS ONCE THE PROGRAM HAD BEEN IN OPERATION FOR A WHILE.

SECTION 6(e) ADDRESSES ANOTHER IMPORTANT FACTOR IN THE UTILIZATION OF FEDERALLY SUPPORTED RESEARCH AND DEVELOPMENT. THIS SECTION PROVIDES A QUALIFIED OPTION UNDER WHICH CENTERS FOR INDUSTRIAL TECHNOLOGY CAN ACQUIRE "... TITLE TO ANY INVENTION CONCEIVED OR MADE UNDER THE AUSPICES OF THE CENTER THAT WAS SUPPORTED AT LEAST IN PART BY FEDERAL FUNDS." IT IS NOT CLEAR THAT THE NON-PROFIT OR UNIVERSITY AFFILIATED CENTERS WILL BE REALIZED SO THAT THE PROSPECTS FOR IMPLEMENTATION OF SECTION 6(e) ARE UNCLEAR.

HOWEVER, I AM VERY SUPPORTIVE OF THE PRINCIPLE THAT THOSE WHO PERFORM RESEARCH AND DEVELOPMENT WITH SUPPORT FROM THE FEDERAL GOVERNMENT AND WHO ARE WILLING TO TAKE THE RISK OF COMMERCIALIZING THE RESULTS OF THAT RESEARCH AND DEVELOPMENT, SHOULD HAVE A CLEAR CHANCE TO DO SO. IN THE PAST, THE POLICIES AMONG FEDERAL AGENCIES HAVE VARIED WIDELY REGARDING ASSIGNMENT OF RIGHTS TO INVENTIONS WHICH RESULTED FROM FEDERALLY SUPPORTED RESEARCH AND DEVELOPMENT. I HAVE SUPPORTED EFFORTS TO ESTABLISH UNIFORM POLICY WHICH FOLLOWS THAT PROVIDED IN SECTION 6(e). LAST YEAR THE "UNIVERSITY AND SMALL BUSINESS PATENT PROCEDURES ACT," P.L. 96-517, WAS ENACTED AND PROVIDES FOR UNIFORM ASSIGNMENT OF PATENT RIGHTS TO QUALIFIED UNIVERSITIES, NON-PROFIT ORGANIZATIONS AND SMALL BUSINESSES. REGULATIONS FOR IMPLEMENTATION OF P.L. 96-517 HAVE JUST BEEN ISSUED FOR COMMENT BY THE OFFICE OF FEDERAL PROCUREMENT POLICY.

IN THE 96TH CONGRESS, THE COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION HELD HEARINGS ON S. 1215, "UNIFORM SCIENCE AND TECHNOLOGY RESEARCH AND DEVELOPMENT UTILIZATION ACT," WHICH I SPONSORED. THIS YEAR I INTEND TO REINTRODUCE THIS LEGISLATION, WHICH WOULD PROVIDE FOR ALL PERFORMERS OF FEDERALLY SUPPORTED RESEARCH AND DEVELOPMENT A UNIFORM FEDERAL POLICY WITH RESPECT TO THE OWNERSHIP OF INVENTIONS. SUCH A POLICY IS BOTH TIMELY AND CONSISTENT WITH THE ADMINISTRATION'S EMPHASIS ON THE RESPONSIBILITIES OF THE PRIVATE SECTOR FOR PROVIDING AND COMMERCIALIZING TECHNOLOGICAL INNOVATION IN THIS COUNTRY. WE WILL BE HOLDING HEARINGS ON THE SUBJECT ON JULY 28.

THERE ARE ALSO SIGNS THAT UNIVERSITIES, INDUSTRIES AND GOVERNMENT ARE MOVING ON THEIR OWN TO COLLABORATE ON TECHNOLOGY INNOVATION AND TRANSFER. THE BUSINESS SCHOOL AT THE UNIVERSITY OF NEW MEXICO HAS OFFERED A COURSE IN TECHNOLOGICAL ENTREPRENEURSHIP, TAUGHT BY PROFESSOR RAY RADOSEVICH, IN WHICH STUDENTS ACTUALLY WORK WITH INVENTOR-ENTREPRENEURS IN THE STATE TO DEVELOP PLANS FOR COMMERCIALIZATION OF THEIR IDEAS. RESULTS SO FAR SUGGEST THAT TWO OF THREE PROJECTS WILL LEAD TO SUCCESSFUL PRODUCT COMMERCIALIZATION.

ANOTHER EXAMPLE, THOUGH, HAS SO FAR BEEN A VICTIM OF ITS OWN SUCCESS. THE UNIVERSITY OF NEW MEXICO ESTABLISHED THE TECHNOLOGY INNOVATION PROGRAM TO PROVIDE ON A BROADER SCALE THE ASSISTANCE WHICH PROFESSOR RADOSEVICH'S STUDENTS PROVIDE IN THEIR CLASS PROJECTS. A REQUEST FOR FUNDING WAS SUBMITTED TO THE STATE LEGISLATURE WHERE THE RESPONSE WAS VERY RECEPTIVE. APPARENTLY

THE RESPONSE WAS SO RECEPTIVE, THAT AGREEMENT COULD NOT BE REACHED ON WHO WOULD SPONSOR THE REQUEST, WHICH SUBSEQUENTLY DIED. THE IRONY OF THESE EVENTS WOULD BE AMUSING IF IT WERE NOT FOR THE IMPORTANT SERVICE WHICH WAS LOST OR AT LEAST DELAYED IN THE PROCESS. NEVERTHELESS, MY MAJOR POINT REMAINS; UNIVERSITIES, INDUSTRIES AND GOVERNMENT ARE REALIZING MORE AND MORE THAT AND HOW THEY RELATE TO ONE ANOTHER IN PROMOTING AND CAPITALIZING ON INNOVATION. MY EXAMPLES ALL CAME FROM NEW MEXICO, BUT I AM SURE THAT EVERY STATE HAS HAD COMPARABLE EXPERIENCES THAT SUGGEST THAT THE INTENT OF STEVENSON-WYDLER IS BEING REALIZED EVEN BEFORE FULL IMPLEMENTATION OF THE LEGISLATION.

SUMMING UP THEN, IT SEEMS THAT THE ACT IS BEING IMPLEMENTED, ALBEIT MORE SLOWLY AND LESS COMPREHENSIVELY THAN HAD BEEN EXPECTED. AT THE SAME TIME, THERE IS A NEW ADMINISTRATION, WHICH HAS HAD TO INSTALL NEW AGENCY MANAGEMENT TEAMS; THIS PROCESS HAS PROCEEDED MORE SLOWLY THAN WE WOULD HAVE ANTICIPATED. PERHAPS MOST IMPORTANT ARE THE QUITE DIFFERENT PLANS OF THIS ADMINISTRATION FOR STIMULATING OUR ECONOMY. THESE PLANS RELY ON STRATEGIES WHICH DIFFER FROM AND MAY IN SOME INSTANCES PRECLUDE SOME OF THOSE PROVIDED UNDER THE ACT.

IT IS PROBABLY TOO EARLY TO JUDGE THE PROGRESS OF THE ADMINISTRATION'S STRATEGIES OR ITS IMPLEMENTATION OF THE TECHNOLOGY INNOVATION ACT. HOWEVER BY THIS FALL AN ASSESSMENT OF THE PROGRESS SHOULD BE IN ORDER. AT THAT TIME MY SUBCOMMITTEE ON SCIENCE, TECHNOLOGY AND SPACE INTENDS TO HOLD HEARINGS, WHICH SHOULD COMPLEMENT YOUR FINDINGS OVER THE NEXT FEW DAYS.

I APPRECIATE THIS OPPORTUNITY TO APPEAR BEFORE YOU AND WELCOME AND QUESTIONS THAT YOU MAY WISH TO RAISE.

Mr. WALGREN. Thank you very much, Senator. We certainly appreciate your interest in this.

On behalf of the committee, we do want to pursue with you the patent area, with real cooperation, because I think all of us recognize that, regardless of what we might be able to do around the edges, the broad impact of individual notification that comes from the patent area is critical.

The Chair would like to recognize Mr. Skeen at this time.

Mr. SKEEN. Thank you, Mr. Chairman, for the privilege.

What I would like to do is add my welcome to Senator Schmitt. I think you gave an outstanding presentation. Of course, you being my Senator from my State, I agree with you totally. [Laughter.]

Senator SCHMITT. Being my Congressman from my district, I agree with you totally. [Laughter.]

Mr. SKEEN. I'm glad it works both ways.

Seriously, I do want to add that I endorse that invitation to the Showcase for Technology, which has been extended, to the members of this committee, Mr. Chairman. I hope you do not take offense, Senator, I'm going to have to get up in just a minute, but I did want to get up and welcome you, and tell you I'm very proud of your presentation. We are very proud of the contribution New Mexico makes to the scientific and technological field. We think that we're going to add a great deal to technological transfer. I appreciate the things you've said, and I think you will take these fellows on without too much difficulty. So I will leave you to their tender mercy.

Senator SCHMITT. I have never taken offense at anything you do. You're much bigger than I am. [Laughter.]

Mr. SKEEN. Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Skeen.

We do appreciate that invitation. I think it would be very worth while for the committee as a whole to see the efforts that went into that showcase.

Senator SCHMITT. Mr. Chairman, I knew it would be successful, but I have been flabbergasted at the response. It will be held in the Albuquerque Convention Center, which is a large center. Most of the display space has already been spoken for by people both in and outside of the State. We already are receiving advance registrations at a rate higher than anybody would normally have expected for this kind of an event.

Apparently, there's a hunger for technology transfer out there, and what we hope, through dynamic displays and interaction with those displays, and through a schedule of seminars, is to put people in contact with people who have the technology to transfer. That's the critical thing. Technology doesn't transfer unless people are transferring it and people have to know who to talk to. And that's basically what we're trying to do with the showcase.

Mr. WALGREN. We look forward to that.

Mr. Brown?

Mr. BROWN. Senator, I want to thank you for being here, and also for your very great contribution, almost unparalleled in Congress, in terms of attempting to develop a policy and focus attention on this very important area. I would like to concur in the statement that you made during your presentation, as to the desires of the House and Senate committees to have a broader program, which would have included the better part of whatever the Carter administration had proposed, as well as many of the initiatives this administration proposed.

I think we all recognize that would be a more effective result. But unfortunately, we are constrained by the circumstances in which we operate here, from achieving that kind of goal.

Mr. Wright, testifying earlier, indicated that there were certain reorganizations being proposed in the Department of Commerce—the creation of Under Secretaries for Economic Affairs, an Assistant Secretary who would deal with productivity and technology matters. Apparently, that's not fully formulated yet, but I wonder if you have sufficient information that you could comment on the impact of this reorganization of the innovation-productivity situation?

Senator SCHMITT. Congressman, I really do not. We have been putting—as I know you have also—a great deal of pressure on the Department of Commerce to get their act together. And I think that their intentions are certainly good. But all new administrations get organized much more slowly than we in the Congress would like for them to do.

My principal interaction with Secretary Baldrige and Mr. Wright so far has been in the area of their response to the National Strategic Minerals and Materials Policy Act of 1980, which is not at all unrelated to what we are talking about. As a matter of fact, if we are going to solve some of our basic strategic and mineral problems, those for which we have no domestic supply or no known potential for domestic supply, then we're going to have to do it through substitutions.

And those substitutions, or alternative ways of accomplishing the same purpose, are going to have to come through new technology. And I suspect many of those new technologies already exist; that they just are either unknown in the broad community, or have not found the transfer mechanism to do that.

And I am still waiting for the Department of Commerce to really get their act together. I would be only guessing if I thought that the organization that they are now putting into place was going to be as effective as we here on the Hill would like to have it. We will just have to wait and see; that is why I suggested that my subcommittee will begin to look at that later in the year, given some more time, and see how it works out.

We are keeping the pressure on them about strategic minerals, though, because that is so absolutely critical right now. This situation doesn't have very much time left, in my estimation, before we are going to be faced with a partial or complete embargo of some particular strategic material for which we have an inadequate stockpile, for which we have inadequate substitutes, and for which we have no known means of protecting either our economy or national security.

I hope this committee will continue their efforts along these lines. I know that Congress, particularly Mr. Santini, has been very active in this area, and it's something we just can't let go on. It's very closely related to the topic before us today.

Mr. **Brown**. I certainly concur with that. And of course, this committee has shared an interest with the House Interior Committee, in that critical area; and I'm sure we will continue diligently to see that appropriate policies are implemented.

I just want to emphasize one point, again, that was made by Mr. Wright in pointing to those provisions of the Stevenson-Wydler Act which he felt he could enthusiastically support, or this administration could. He made reference to section 5(c), which basically deals with data collection, policy analysis, and data analysis functions. This language, I think, originated in the Senate, and it's very broad language, it's very important language, including a paragraph that says:

> Proposal and support studies and policy experiments, in cooperation with other federal agencies, to determine the effectiveness of measures with the potential of advancing the United States' technological innovations.

In a sense, I sort of feel that this act and many of its initiatives are subsumed under that one paragraph. They're policy experiments, basically, to determine how we can have an impact on this problem. And Mr. Wright indicated that they are proposing to give a good deal of emphasis to this whole question of collecting appropriate data, and managing and analyzing that data appropriately.

I would like to solicit your comments as to the importance of this area, since it is an area in which we can agree with this administration. I know I agree with them on everything, but some of us don't. [Laughter.]

I would like to have you comment as to your own feelings, as to the importance and priority of this section of the act.

Senator **Schmitt**. The section is very important and I support it fully, and hope that the administration will move forward in what you would call "policy experiments." However, I find that this administration so far, as well as the previous one, tends not to look at where we have already conducted successful experiments in technology transfer—and there have been many. There have been some failures, but there have been some outstanding successes, as well.

I have already mentioned one, and that is the aeronautics program. That was technology transfer. Technology transfer was built into that program, and is literally built into any new program that the Congress approves in research, technology, and development.

Another one that we tend to forget, that I also mentioned in my opening remarks, is the Agricultural Research and Extension Service. Now, it has worked for a different reason than the NASA aeronautics program, I think, basically because we kept the Department of Agriculture largely out of it. It was put out into the land grant colleges; it was something managed at the local level. The research was at the local level, and transfer was at the local level. And it has been an outstanding success, as a result of that kind of system.

There are, I am sure, other examples; but those two are the ones which we certainly ought to use as a model in our thinking for doing other things.

Mr. **Brown**. I think you should mention the communications satellite.

Senator **Schmitt**. As a matter of fact, I had three examples in my mind, and that was the other one. There we developed the technology within the Government, almost entirely; then at the right time, we said, "that's it, it's time to spin it off." And we spun it off. We created Comsat. The only mistake we made there—and I hope we learned, and we have learned, in fact, in retrospect—that we didn't maintain research and technology efforts within NASA that would look ahead, wherever the commercial sector could be operating.

We're back into that business now. And through this committee's efforts and my own, I hope that we will maintain a kind of technology effort in communications.

Those three examples are good ones upon which we can model other activities. Certainly, I think that in certain areas of energy research and transfer, we ought to model ourselves after the agricultural research and extension effort. Get it out into the local area, where particular techniques are going to be used, and where regional differences could be important.

We can also apply the research and technology efforts of NASA and aeronautics to our transportation system, to ground-propulsion systems of various kinds, to seek the development of a competitive high-technology merchant marine. There are many areas where these efforts could be applied.

As in the Comsat area, as the Congressman is well aware, I think we should spin off our remote sensing, our Landsat and related systems, and get them out of the Government. They're never going to become operational if we keep them in the Government. If there's one lesson we've learned in 17 years, it's not to keep these technologies in the Government, or you'll never realize the potential benefit.

Mr. **Brown**. Senator, I can only stress the hope that your views continue to have a very large influence in the present administration. [Laughter.]

Senator **Schmitt**. I join you in that.

Mr. **Walgren**. Thank you.

The Chair recognizes the ranking minority member, Mrs. Heckler.

Mrs. **Heckler**. Thank you, Mr. Chairman.

Well, you have received high commendations from the committee, Senator. There's hardly anything that I can add to what my colleagues have just said.

I wonder, however, in related subjects, since you did allude to other policies, whether or not you are satisfied with the tax proposal out of the Senate Finance Committee, and its relationship to technological innovation and development activities?

Do you feel it goes far enough?

What do you think of the assets, in terms of supporting the basic thrust of what the act engenders, and in our basic goals and missions in the area of technological breakthroughs and transfers?

Senator **Schmitt**. I think it takes some important steps in the direction that I would like to see, but I am not satisfied with it fully. The section in the Senate bill—or the Finance Committee bill—which deals with a tax credit, I believe for research and experimentation and the wages paid for that, is an important step.

But again, I think it could be expanded with essentially no dynamic cost; maybe a little static cost, but no dynamic cost to the Government or to the taxpayer.

In fact, I think it would very rapidly result in increased revenues, rather than decreased revenues.

I am not happy about the lack of significant incentives for new savings and investment by all the sectors of our economy. As you may be aware, I have tried for several years to get the Congress to agree to an across-the-board 25-percent exemption, for income earned on savings and investment. We should exempt it all; it makes no sense at all to tax income on savings and investment.

But politically let's say that we start with a 25-percent exemption—that is across the board—which is not targeted to any particular investment instrument or technique. That will provide an after-inflation incentive for Americans at essentially all income levels to begin to save and invest a portion of their income in their future and, consequently, in the Nation's future.

I will be offering an amendment to bring that concept into the tax bill, at least as a later phase, when we deal with the bill on the Senate floor this week.

I hope that my colleagues will follow the advice of many economists and others around the country, that you can't target those savings and investment incentives; all you do is transfer money from one savings instrument or one investment instrument to another. As soon as you target, that starts to happen, and you do not have a new incentive for new investment.

Now, what does that have to do with technology? As we saw in the capital gains tax reduction a few years ago, most of that new venture capital which we created by new savings and investment goes into the small- and medium-sized high technology firms and companies that need to have capital in order to get their ideas out into the market place, to be able to compete with the more bureaucratic technological approaches of the larger corporations.

It's absolutely essential that we have these kinds of incentives. And I hope, if not this year, that in the next year we will see them more broadly applied, through the tax code.

Mrs. HECKLER. Well, Senator, there is a group of Republicans, in which I am very active, that are trying to address some concerns of the high technology industry. We would like to see a liberalization of the R. & D. tax credits in the current bill. Today we are sending a letter to the President, asking for a much more liberalized version of the 25-percent tax credit for R. & D. wages, and certainly an understanding of the need to donate equipment to universities in order to upgrade training facilities.

I really don't think that this would cost the Government a great deal.

Senator SCHMITT. I should have mentioned that a provision along that line is also in the Senate Finance Committee.

Mrs. HECKLER. Well, I would hope the Senate bill could be liberalized on the floor.

Senator SCHMITT. So do I.

Mrs. HECKLER. It could really give a major thrust to this industry, because it certainly is capable of high productivity. Since the economic crisis in America is not just inflation but productivity, I certainly think that the tax bill should be geared to meet this need. I agree with you in terms of investment, but I also feel that the research and development tax credits are very important for the smaller companies, who are making some of the most important breakthroughs.

Senator SCHMITT. Well, I couldn't agree with you more, and I hope we can expand those provisions. The problem we're running into—and I'm sure the Congresswoman is well aware of—is that nobody has been able to figure out how to convince the political world that there is a dynamic tax revenue increase with certain types of tax cuts or tax rate cuts, or tax credits or investment credits.

We have shown, in studies conducted on NASA technologies in several different specific areas, that there's a $5 to $10 return in 5 to 10 years on every dollar that we invest of Federal revenues in these kinds of technology.

Obviously, with that kind of return to the gross national product, there is a comparably increased return to the Treasury. We've just got to use some common sense to realize that the fastest way you can get new productivity, new jobs is to encourage small- and medium-sized businesses to invest in the future.

Sixty percent of the people employed in this country are employed by small- and medium-sized businesses of various kinds, and not an insignificant number of them are employed in the high-technology, medium-technology sector of those businesses, of our economy.

Mrs. HECKLER. Thank you very much, Senator.

Mr. WALGREN. Thank you, Mrs. Heckler.

Mr. Shamansky.

Mr. SHAMANSKY. No questions, Mr. Chairman. Thank you.

Mr. WALGREN. Mr. Gregg.

Mr. GREGG. No questions.

Mr. WALGREN. Mr. Ertel.

Mr. ERTEL. Thank you, Mr. Chairman.

I welcome you, Senator Schmitt. It's nice to see you again.

I notice that you talk about patent technology for patents and patent policy and uniform patent policy. I am happy to hear that we are working together on that, and hopefully we will have something to present soon.

Senator SCHMITT. Before you came in, Mr. Ertel, we did discuss the cooperative efforts that we have undertaken with the committee and are really looking forward to marching down that path in parallel. Hopefully in a few months we will have something we can recommend to our colleagues as a whole in both houses.

I'm optimistic as I know you are, and I think we are going to be able to work the details out.

Mr. ERTEL. I hope so. We certainly got a long way the last time, and we are going to finish it this time, I hope.

Nice to be with you.

Mr. WALGREN. Thank you, Mr. Ertel.

We have a special colleague sitting with us, Wes Watkins from Oklahoma and member of the Appropriations Committee. Wes has, as you know, had an ongoing interest in this whole area, and I'd like to recognize him at this time.

Mr. **Watkins**. Thank you, Mr. Chairman.

I want to express my thanks to you and your committee for allowing me to come back home, so to speak, to this particular subcommittee. I know Congressman Brown, served as chairman of the subcommittee last Congress when we worked on section 11 of the bill. Several of my colleagues here and others have shared, a concern in section 11 of the act. That's why I came back over today.

I want to express my thanks to the chairman for asking Mr. Wright from Commerce some questions that I had intended to ask. I had to leave because I had to go to Appropriations to help fund this program. I got there just at the time when we ran out of money, so I don't know if I'm hitting a good average or not.

Let me say I want to express my deep appreciation for your leadership over in the Senate, Senator Schmitt, in the whole area of technology transfer, science research technology efforts, and also for supporting 96-480 and section 11. The Stevenson-Wydler Act is of vital importance to the economic development and productivity in this country.

I want to elaborate just briefly. You mentioned agriculture, and my background is agriculture. When I reviewed technology transfer in agriculture, I realized reasons that it has been successful. We recognized a tremendous need for technology transfer early. Yes, sir, we had the land grant universities out there performing experimental work. We utilized 10 percent of that research money for technology transfer, to provide extension services, experimental stations, and ag teachers. We used 10 percent.

So, when we started working on this section of the bill, we proposed, I believe 5 percent of R. & D. funds for technology transfer at first; but I think it came all the way down to .5 percent.

When we first started, it was 5 percent, which is 50 percent of what ag uses, which came down to 2 percent and 1 percent, and finally one-half of 1 percent. In this country we need to place priority on getting out there, in a working practical way, this technology that is developed in our laboratories. Nearly $40 billion a year is spent on it, and much of it is shelved, although a lot of it is being used.

Until we find that's a priority and feel it's a mandate, I don't think that our Government is going to have the role it should in helping stimulate the economy and the productivity of this country, such as we have done in agriculture.

You know, we have 3 percent of our people in the country today engaged in farming and the cattle business, and we feed our country and nearly a third of the world. That's the kind of productivity we have in agriculture. Since those are my roots, I kind of have to discuss that just briefly.

I think we can use that as an example for other technology, and I am worried and I am concerned about the direction that the administration is going to take.

You're a former astronaut, and I have tremendous respect for your achievements and your work in NASA, and I know you realize what the Technology Utilization Division of NASA has done to try to disseminate NASA technology and to try to create priorities in the thinking of our people on spinning off, using the term that they utilize there and you used a while ago, that technology.

However, the administration has called for the termination of the NASA tech applications program and phasing out of its technology utilization program. Do you feel like I do? Does this concern you as far as how we're going to get this technology out?

NASA has, you know, basically been one of the few that's had the mandate, other than agriculture, to get technology transfer out to the people.

Senator SCHMITT. Mr. Watkins, I share your concern. I am a member of the Appropriations Committee and also the Science, Technology and Space Subcommittee and I hope we can do something about that.

The Technology Utilization Section of NASA really has done well, but has always been underfunded, even under other administrations.

Now, one of the problems maybe is that each area of technology is going to take a different style of effort for transfer. I think we sort of waltzed into the agricultural system, and it has worked very well. As I indicated earlier, I think it is a model we could apply to certain aspects of energy technology transfer; we should conduct more of our intermediate energy and technology development in the university system and develop an energy extension service that actually works in parallel with and maybe in conjunction with the agricultural service.

On the other hand, in aeronautics we organized that program directly as an academic/private sector/government cooperative research effort, and they worked side by side. In that specialized area of aeronautical commercial activity, transfer has occurred very efficiently and very well.

In the case of NASA's space and technology, obviously the aerospace industry was receiving the benefits of transfer automatically because they were doing all the contractual work.

On the other hand, the medical community has not been receiving the benefits of transfer nearly as fast as it could absorb them. The technology utilization group played a very effective role in implementing of significant portions of that transfer into the medical community.

So, I think that if we can maintain NASA Technology Utilization and begin to look at how can we focus it in the areas where technology transfer does not naturally occur; then we'll get a far greater bang for the buck. I could say that for other R. & D. agencies, too.

With hearings like this and our further examination of the Stevenson-Wydler Act, and with other activities of our two committees, I think we can assist the Administration in getting away from the across-the-board cuts that we have seen and be more specific about where can we effectively assist the private sector in utilizing the technologies developed under Federal auspices.

Mr. WATKINS. I concur with what you are saying, because we had an attitude of wait and see if someone comes and hunts it up. We haven't generated this effort in many of our areas.

Likewise, let me ask you to comment on the administration's fiscal year 1982 budget to seek zero funding for both the Center for

Utilization of Federal Technology in the Department of Commerce and the governmental program sector of NSF which funds the Federal Laboratory Consortium. Both those organizations were assigned specific technology transfer functions under section 11.

We feel strongly about implementing the Stevenson-Wydler Act, and having a significant role in improving productivity and helping the private sector get the information they need. Would you like to comment on that?

Senator SCHMITT. Mr. Watkins, I have found that the one thing the administration works the hardest to do is maintain their overall budget levels. In my Appropriations Subcommittee on Labor, Health, Human Services and Education, we made some major readjustments of priorities underneath that umbrella, and we got very little, if any, resistance in return.

Frankly I think that, comparably, in the two areas you mentioned, we in the Commerce Committee and with others involved in NSF funding can adjust those numbers, so long as we recognize that the administration and the people of this country want you to maintain a reduction in the rate of growth of Federal spending.

As long as we do that, I think we can adjust those priorities in any way that is rational and makes good commonsense, and that we will have no particular battle with the Administration in that respect.

Mr. WATKINS. I think we could. We appreciate your help over in the Senate.

I think we all know that we've got a cap that we're working under. If we'd just get the TU increased enough that we can get the technology that's developed disseminated out there to the people out in the farms and small towns and villages across this country so they can utilize it—and be able to utilize that technology for their own increase in production and their own economic development.

I appreciate your tremendous interest. And I rest a little easier because I know you're over there and I know of your interest.

I want to thank the chairman of this subcommittee and the other members of this subcommittee for their indulgence in allowing me to come back to the subcommittee to discuss some of these things that are very important to the overall economic growth and productivity of this country of ours.

And I thank you very much for your help.

Senator SCHMITT. Thank you very much.

Mr. WALGREN. Thank you very much.

The last panel we have is an industry panel, made up of Mr. Douglas Danforth, who is chief operating officer of Westinghouse Electric Corp.; Mr. William Mericle, group vice president of Cincinnati Milacron; and Bernard M. Sallot, director of professional and governmental activities, Society of Manufacturing Engineers.

[The biographical sketches of Douglas D. Danforth and William Mericle follow:]

DOUGLAS D. DANFORTH

Vice Chairman and Chief Operating Officer
Westinghouse Electric Corporation

As vice chairman and chief operating officer, Douglas D. Danforth is responsible for operations of the corporation's three principal companies -- Industry Products, Power Systems and Public Systems -- and the International organization.

Elected to this newly created corporate position in 1978, he had been president of the Industry Products Company since 1974. In January 1974, he was appointed senior executive vice president of the Industry Products Company, and prior to that he served for five years as executive vice president of components and materials within Industry Products.

Mr. Danforth joined Westinghouse in 1955 as executive vice president and general manager of Industria Electrica de Mexico, a corporate affiliate in Mexico City.

In 1961, he was transferred to corporate headquarters in Pittsburgh as assistant to the vice president of manufacturing. He was then named general manager of the control divisions. In 1962, he was elected a Westinghouse vice president. In 1963, he was appointed executive in charge of the industrial group and the following year became vice president and general manager of the consumer group.

Mr. Danforth earned a bachelor's degree in mechanical engineering from Syracuse University in 1947.

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He is a member of the board of trustees for Syracuse University, Carnegie-Mellon University, The Greater Pittsburgh Guild for the Blind, and the Allegheny Health, Education, and Research Corporation. He also is a member of the board of directors of PPG Industries, the Pittsburgh National Corporation, and the United Way of Allegheny County.

He is married to the former Janet Mae Piron, and their home is in the Pittsburgh suburb of Mt. Lebanon. The Danforths have four children.

A native of Syracuse, N.Y., Mr. Danforth was born on September 25, 1922.

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CINCINNATI
MILACRON

WILLIAM F. MERICLE

William F. Mericle is a group vice president of Cincinnati Milacron Inc., with responsibility for the company's plastics machinery operations, worldwide. He was elected director of the company on April 24, 1979.

He graduated from Ohio State University in 1943 with a bachelor's degree in industrial engineering.

Shortly after joining the company in 1965, Mericle was named manager of the Forming Division. He subsequently spearheaded the formation and development of the company's Plastics Machinery Division, and was elected a corporate vice president in 1969.

Prior to joining Milacron, Mericle was employed by Cincinnati Inc. as vice president of manufacturing and then vice president of marketing.

Mericle served as Lieutenant in the Navy during World War II.

Mericle served as Chairman of the Machinery Division of The Society of the Plastics Industry from 1976 to 1979. He was elected director of S.P.I. in 1980 and is currently serving as Treasurer of S.P.I. He is also a director of U.S. Precision Lens.

July, 1981

TESTIMONY OF DOUGLAS D. DANFORTH, CHIEF OPERATING OFFICER, WESTINGHOUSE ELECTRIC CORP., WILLIAM F. MERICLE, GROUP VICE PRESIDENT, CINCINNATI MILACRON, INC., AND BERNARD M. SALLOT, DIRECTOR, PROFESSIONAL AND GOVERNMENTAL ACTIVITIES, SOCIETY OF MANUFACTURING ENGINEERS

Mr. **Walgren**. As a point of some personal privilege, Mr. Danforth comes from my hometown. I represent six counties, but I only grew up in one of them, and it is a hometown that Mr. Danforth and I both share.

I couldn't help but see in the newspaper this morning that Westinghouse profits are up 7.5 percent in the last quarter. But perhaps more importantly, that's attributed to the contribution from the Industry Product Unit, which Mr. Danforth was president of until 1978. On the Democratic side, we also attribute all the improvements in the economy to the last administration, and I'm sure that you deserve a good deal of credit for that improvement in profits at Westinghouse.

Written statements will be made part of the record. Please feel free to let us know your feelings in this area, however they suit you best.

I would like to ask Mr. Danforth to proceed first, and I understand that you have a commitment, so we will hear Mr. Danforth, and then ask brief questions; and then hear from the other two members of the panel, if that's all right with you gentlemen.

Please proceed.

Mr. **Danforth**. Thank you, Mr. Chairman. Good morning.

I am Douglas Danforth, vice chairman and chief operating officer of Westinghouse Electric Corp., and I do appreciate your invitation to join in this discussion of Public Law 96-480, the Stevenson-Wydler Technology Innovation Act of 1980.

Mr. Sallot of the Society of Manufacturing Engineers has told me that he plans to concentrate his remarks on the implementation of this law. So, let me defer to Mr. Sallot any comments on the act, and focus my remarks on the problems and challenges facing industrial innovation and technology in this great country of ours.

I think we agree that the future vitality of American industry will depend on how well we can develop and apply innovative scientific and engineering ideas, not only in the United States, but the world over.

We are living in an age of accelerating worldwide competition. But American industry has been losing some of its technological edge that we enjoyed for many decades. Other countries, more disciplined in their economic policies and more enlightened in their use of resources, have been catching up to us.

As a result, our country's share of world exports has declined. We had a 40-percent share in 1950, and only 15 percent last year. Our balance of payments for merchandise has been in the red for the past 4 years, with deficits averaging $30 billion and more each year.

Now, foreign manufacturers—and this is, in some respects, very good—have been successful in penetrating our markets, where we haven't been all that successful in penetrating theirs.

In 1960, the United States imported only 5 percent of its consumer electronic goods. Today, we import over 51 percent.

Also in the 1960's, only 3 percent of our metal-working equipment came from overseas; and today, we import over 23 percent.

In 1960, we imported only a fraction of 1 percent of our electrical components. Today, we import over 20 percent.

These market losses, both at home and overseas, mean lost jobs, lost profits, lost taxes, and, unfortunately, lost opportunity.

They are especially discouraging when you consider that this country has been the world's leader, in terms of invention and innovation and creativity in the technical area.

Take, for example, the number of patents issued each year in the United States. The number of domestic patent applications by Americans has been flat, really, for the last several years. In contrast, the number filed here by those from other countries has been rising rather speedily. Last year, almost 38 percent of the patents granted in this country were granted to foreign applicants.

Now, it's an indisputable fact that the United States is dead last in productivity growth rate, compared to all modern industrialized nations in the last decade. A two-decade era of industrial decline, relative to the rest of the industrialized nations of the world, has brought us to a point today where much of our industry is less efficient than Japanese, West German, French, or Canadian industry. Most of our consumer electronics are imported, as I said before. Last year, Japan alone produced more cars and trucks than we did in the total industrial base here.

Any visitor to Japan can quickly see the results of the tremendous investment that country has made in technology and productivity. I was in Japan last fall—and I try to go over at least once a year—and visited a number of factories, including Fijutsi Fanuc, a leading robot manufacturer in Japan. We saw robots making parts for more robots. During the day, people work in the factory, maintaining the machines, moving material, and performing setup operations. At night, the lights are turned out, and the robots continue making more robots, and second and third shifts are all unattended.

We also visited Yamazaki, a leading Japanese machine tool builder that produces a sophisticated numerically controlled machine tool, or machining center, and they produce one every 40 minutes. And their centers run unattended all night, making the same parts, of course, for the machine centers that are assembled there.

We toured an automobile plant of Toyota that produces about four times as many engines per employee as U.S. engine plants do. We toured a Toyota auto assembly plant, which starts out with sheet steel and processes it into finished automobiles, at the rate of two per minute. And by utilizing their ingenious "KAN BAN" production system, they do this with less than half the plant work force, about one-third the factory space, one-half the investment, and about one-tenth the work-in-process inventory of comparable U.S. auto manufacturers.

Of even greater interest are the futuristic manufacturing capabilities Japan now has under design.

For example, Japan's Ministry of International Trade and Industry—which is commonly referred to as MITI—in cooperation with major Japanese companies, is helping to fund a $60 million flexible machining system complex. This system will use high-energy lasers to manufacture diverse machined parts. The technology could revolutionize machining of small batches of diverse parts, by combining the efficiencies and economies of a fully automated production line with the capability of manufacturing small-batch quantities as low as one or two pieces. We have no comparable development, to the best of my knowledge, underway in the United States.

MITI also is funding a $140 million effort to advance the manufacture of high quality integrated circuits, and a $150 million program to develop a supercomputer that will be 66 times faster than anything on the market today.

By far the most ambitious and exciting project underway in Japan, also being sponsored and supported by MITI, is a fifth-generation computer for the post-1990 period. This computer, according to MITI, would have artificial intelligence and the ability to solve problems with no direct software input, much the way a human brain solves problems. It will also incorporate voice and pattern recognition, instead of using keyboard inputs. There is no known, at least, other computer R. & D. project of such far-reaching nature anywhere else in the world.

Now, I cite these as just a few examples to show how we, as a Nation, are being challenged on the technological front. Now, we still have the lead, fortunately, but we will have to really intensify efforts to step up our productivity on a national basis, if we are to retain that lead.

Now, there will be many steps that we will have to take. In the time I have this morning, let me just mention three of them.

First, we will have to increase both innovation and productivity—stimulating innovation at our research labs, at our universities, and in industry, and improving productivity certainly in our work force.

Now, in support of this effort, Westinghouse is the primary sponsor of factory of the future projects at Carnegie-Mellon University's Robotics Institute in Pittsburgh. This institute was established to bring the university's expertise to bear upon the problem of increasing national productivity and stepping up the development of new manufacturing technology.

Now, we have also undertaken a major effort to stimulate innovation among our engineers. Senior management, early this year, established an engineering advisory council, and its assignment is to recommend to management new policies and actions that will strengthen our overall technological leadership.

This council also will sponsor specific activities designed to stimulate innovation, such as educational courses, recognition programs, and communication projects that encourage the exchange of technical information, not only within Westinghouse, but within industry at large.

We have also created the position of vice president for corporate productivity. One of his responsibilities is to direct our new productivity center in Pittsburgh, where new concepts are being evaluated to advance the state of the art in a broad spectrum of productivity-improvement methods. And, again, we are sharing this with other industry in the area.

We have established this center as part of a major effort launched at Westinghouse in 1979, to improve our internal efforts. Since then, corporate productivity has climbed about 12 percent, and our corporate goal is to boost productivity by at least 70 percent over the next 9 or 10 years.

These activities and objectives are in concert with the stated purpose of the Stevenson-Wydler Act, to stimulate manufacturing technology.

But innovation and technological advancement are expensive. And the second requirement, therefore, will be to encourage more capital investment in this area. Capital is needed for new facilities and productivity-improving equipment, and for replacing obsolete equipment in factories and offices. And when you talk about productivity, I am talking about the office, as well as the factory floor.

The United States invented such things as machining centers, numerically controlled machines, and robots—and essentially all the other items that are needed in the modern automated factory. And the reason we are losing out to foreign industry is not the lack of inventive genius, but the lack of available capital for adequate R. & D. to modernize and develop these concepts.

Today, equipment in the average U.S. plant is 20 years old. The average of the same equipment in West Germany is about 12; and in an equivalent plant in Japan, it's 10 years.

Now, in research and development, the ratio of our expenditures to GNP has also lagged. It decreased nearly 24 percent over the last 15 years. A recent Government report noted that the regulatory compliance procedures for some industries were consuming up to 40 percent of the average new R. & D. expenditures.

We need to reverse this trend. Government and industry must continue the process that is now underway, of working together to eliminate regulatory and taxation barriers, barriers that have limited plant modernization and R. & D. investments. Our national policy should be one of encouraging these investments.

The third, and most important, element in promoting more U.S. technological innovation concerns people. We must be sure that we use the capabilities and potential of employees to the fullest.

As we move to the office and the factory of the future, we will have to pay more attention to the needs of the individual workers. This means opening communication channels between employee and employer; it means making people feel good about their jobs again; it means tapping one of our most underutilized resources—our people. Because you can't just develop technology. You have to have the people to apply the technology, and apply it willingly and enthusiastically.

One of the several ways we've started tapping this creativity at Westinghouse is through our quality circles program.

In a quality circle, small groups of production, administrative, or service employees voluntarily get together about an hour a week, to solve job-related problems or to introduce new ideas. These might be related to quality, productivity, safety, or even the quality of their working life—the area that they perform their tasks in. The members of the quality circles come up with their own solutions, and then present them to the management team, which is ready and anxious, in most cases, to implement all the good ideas that we have received.

We now have—and we have only been at this a couple of years—700 quality circles, with 7,000 employees participating in those, at 150 different locations around the world. By the end of the year, we will have over 10,000 people involved, with about 1,000 quality circles.

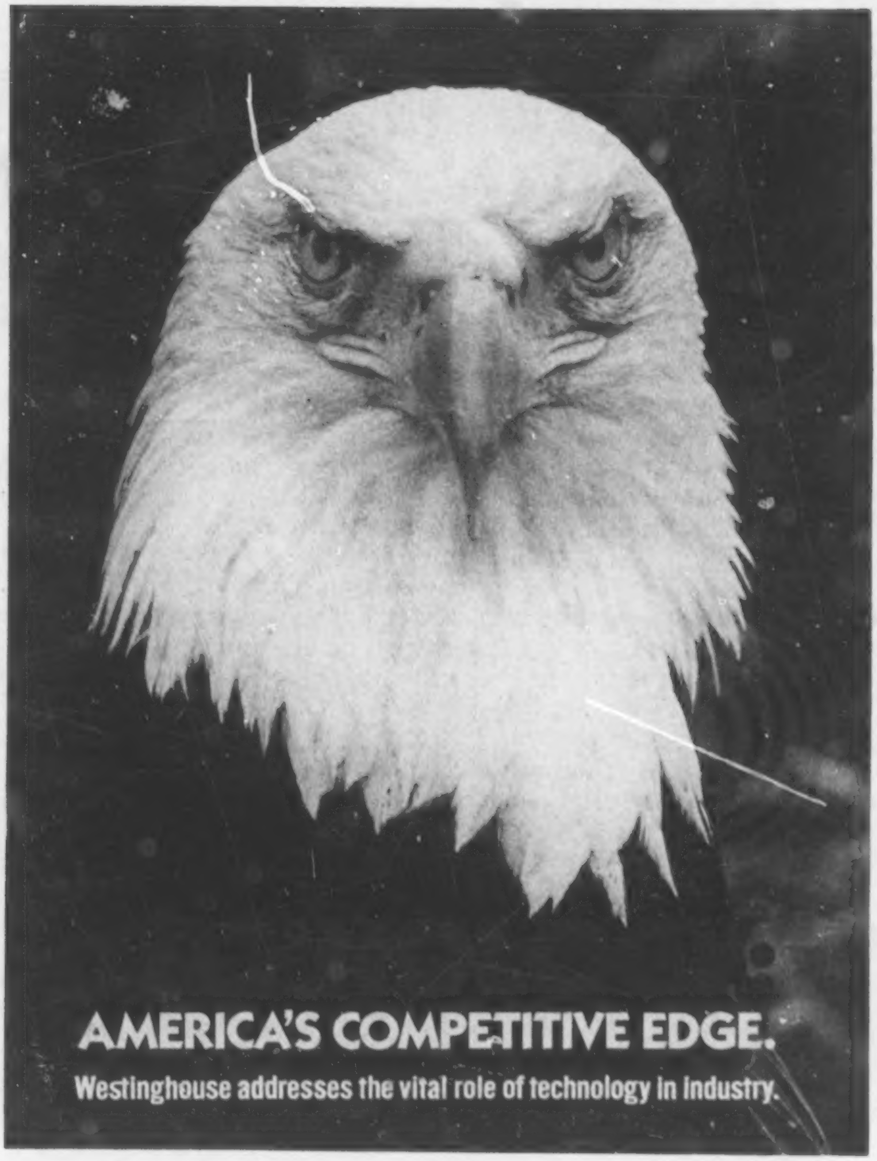
We find that when employees are asked what to do, instead of being told what to do, they respond to the challenge with really great enthusiasm and good ideas. They become more innovative and the morale goes up, and they feel that they're part of the solution. Now, we all like to feel that we really are participating in the solution to specific problems or tasks.

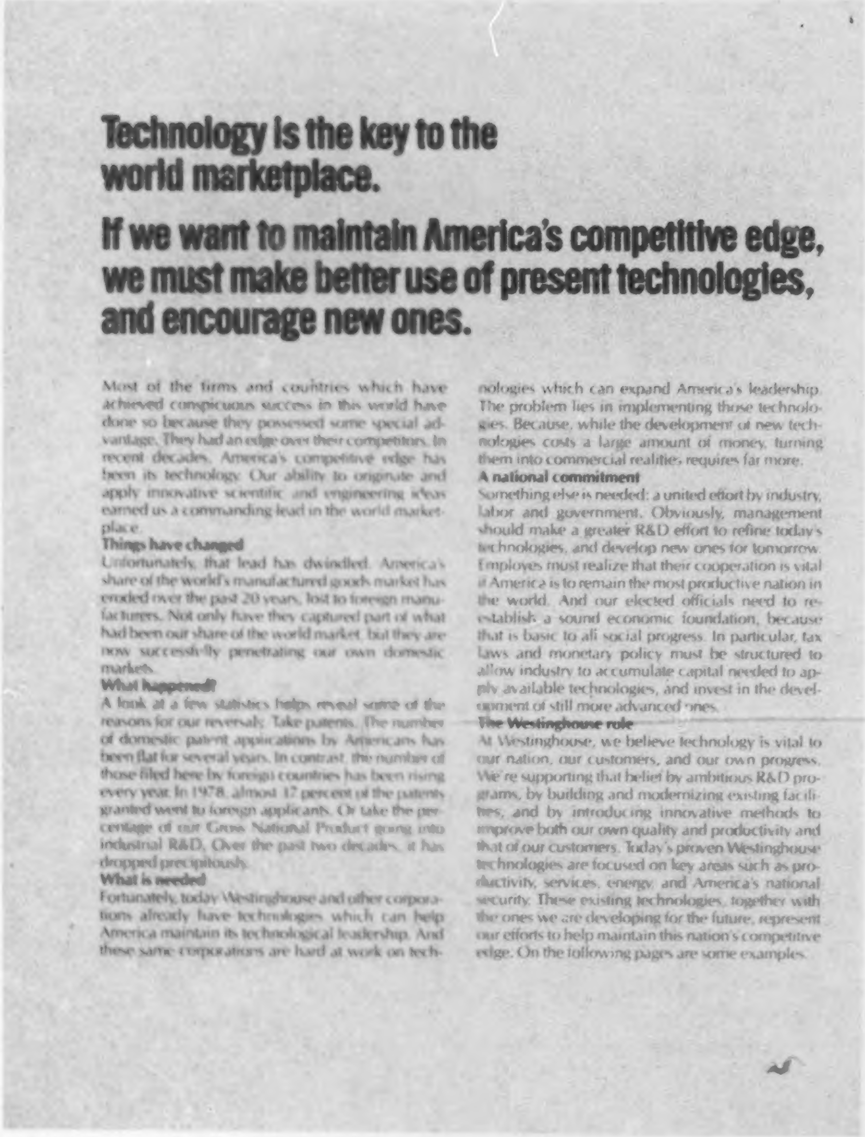
Mr. Chairman, my company has been in the technology business for nearly a century, and we think it's the key to the world marketplace. We want to maintain America's competitive edge—I'm sure we all do—we simply must make better use of existing technologies and certainly encourage the transfer and development of new ones.

Concentration on achieving these goals is an essential next step for the Congress and this administration to follow. And the important decisions that you are faced with on the budget, of course, are very key to this issue, as you have discussed before with Senator Schmitt.

I have with me this morning, for each of you and the members of the panel, an 8-page pamphlet on technology that we have sent to leaders of American industry. I'd like to submit this for the record. I think it puts in capsule form some of the things that I have just been talking about.

[The document follows:]


AMERICA'S COMPETITIVE EDGE.
Westinghouse addresses the vital role of technology in industry.



Technology is the key to the world marketplace.

If we want to maintain America's competitive edge, we must make better use of present technologies, and encourage new ones.

Most of the firms and countries which have achieved conspicuous success in this world have done so because they possessed some special advantage. They had an edge over their competitors. In recent decades, America's competitive edge has been its technology. Our ability to originate and apply innovative scientific and engineering ideas earned us a commanding lead in the world marketplace.

Things have changed

Unfortunately, that lead has dwindled. America's share of the world's manufactured goods market has eroded over the past 20 years, lost to foreign manufacturers. Not only have they captured part of what had been our share of the world market, but they are now successfully penetrating our own domestic markets.

What happened?

A look at a few statistics helps reveal some of the reasons for our reversals. Take patents. The number of domestic patent applications by Americans has been flat for several years. In contrast, the number of those filed here by foreign countries has been rising every year. In 1978, almost 37 percent of the patents granted went to foreign applicants. Or take the percentage of our Gross National Product going into industrial R&D. Over the past two decades, it has dropped precipitously.

What is needed

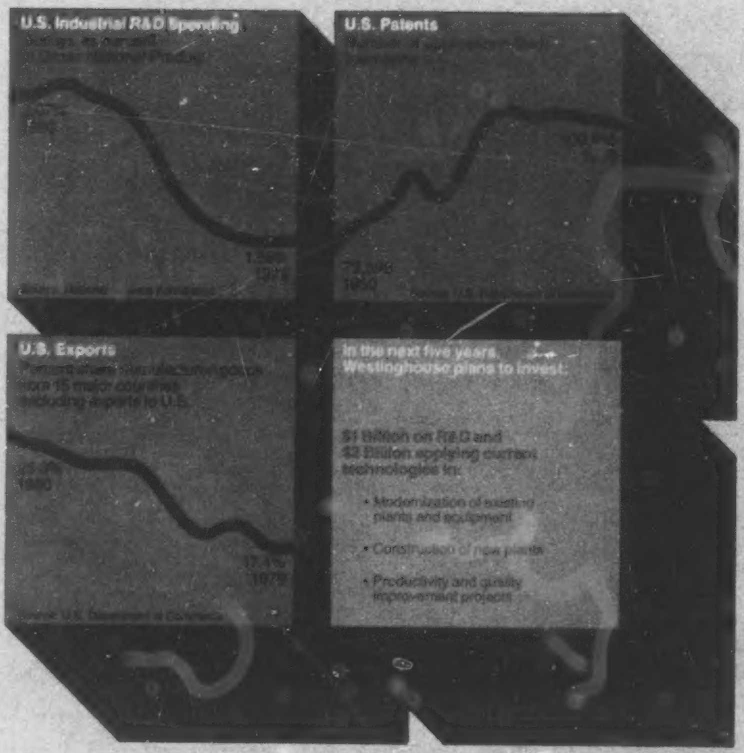
Fortunately, today Westinghouse and other corporations already have technologies which can help America maintain its technological leadership. And these same corporations are hard at work on technologies which can expand America's leadership. The problem lies in implementing those technologies. Because, while the development of new technologies costs a large amount of money, turning them into commercial realities requires far more.

A national commitment

Something else is needed: a united effort by industry, labor and government. Obviously, management should make a greater R&D effort to refine today's technologies, and develop new ones for tomorrow. Employes must realize that their cooperation is vital if America is to remain the most productive nation in the world. And our elected officials need to re-establish a sound economic foundation, because that is basic to all social progress. In particular, tax laws and monetary policy must be structured to allow industry to accumulate capital needed to apply available technologies, and invest in the development of still more advanced ones.

The Westinghouse role

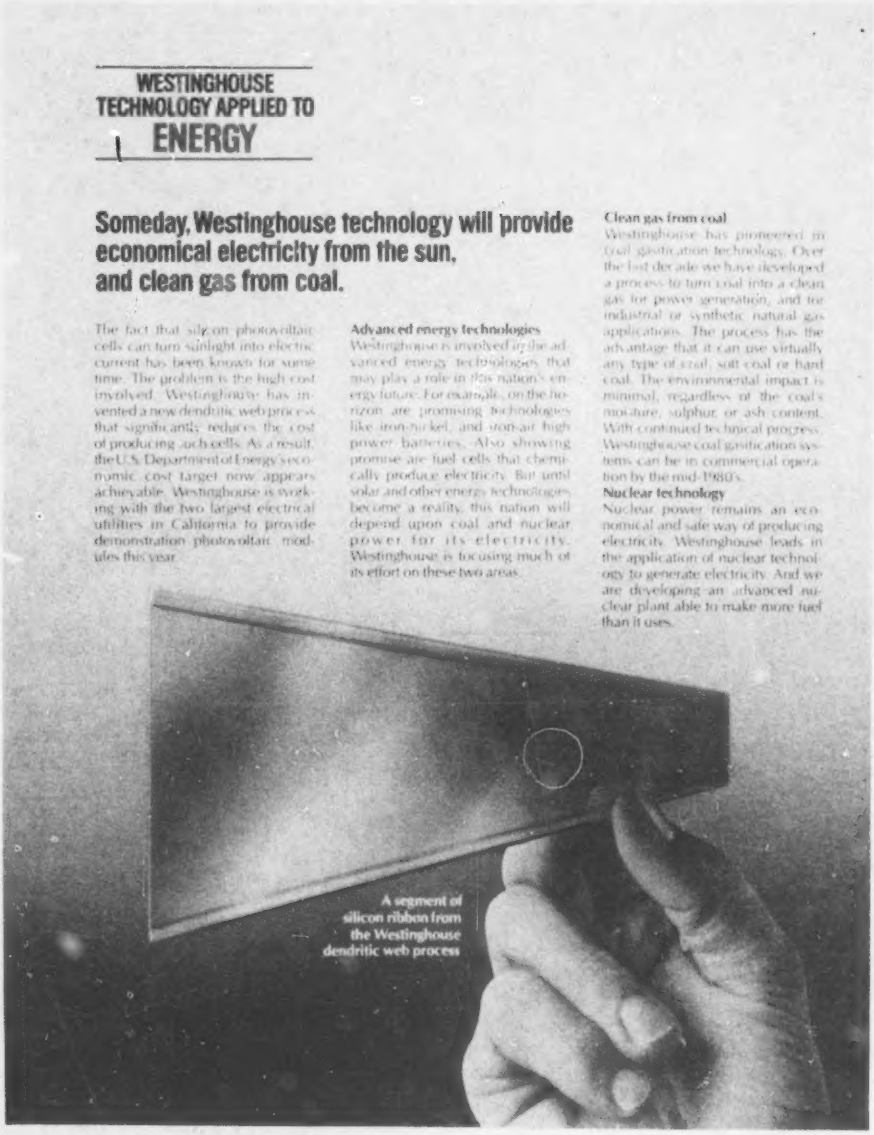
At Westinghouse, we believe technology is vital to our nation, our customers, and our own progress. We're supporting that belief by ambitious R&D programs, by building and modernizing existing facilities, and by introducing innovative methods to improve both our own quality and productivity and that of our customers. Today's proven Westinghouse technologies are focused on key areas such as productivity, services, energy, and America's national security. These existing technologies, together with the ones we are developing for the future, represent our efforts to help maintain this nation's competitive edge. On the following pages are some examples.



In the next five years, Westinghouse plans to invest:

$1 Billion on R&D and
$2 Billion applying current technologies to:

- Modernization of existing plants and equipment
- Construction of new plants
- Productivity and quality improvement projects



WESTINGHOUSE TECHNOLOGY APPLIED TO ENERGY

Someday, Westinghouse technology will provide economical electricity from the sun, and clean gas from coal.

The fact that silicon photovoltaic cells can turn sunlight into electric current has been known for some time. The problem is the high cost involved. Westinghouse has invented a new dendritic web process that significantly reduces the cost of producing such cells. As a result, the U.S. Department of Energy's economic cost target now appears achievable. Westinghouse is working with the two largest electrical utilities in California to provide demonstration photovoltaic modules this year.

Advanced energy technologies

Westinghouse is involved in the advanced energy technologies that may play a role in this nation's energy future. For example, on the horizon are promising technologies like iron-nickel, and iron-air high power batteries. Also showing promise are fuel cells that chemically produce electricity. But until solar and other energy technologies become a reality, this nation will depend upon coal and nuclear power for its electricity. Westinghouse is focusing much of its effort on these two areas.

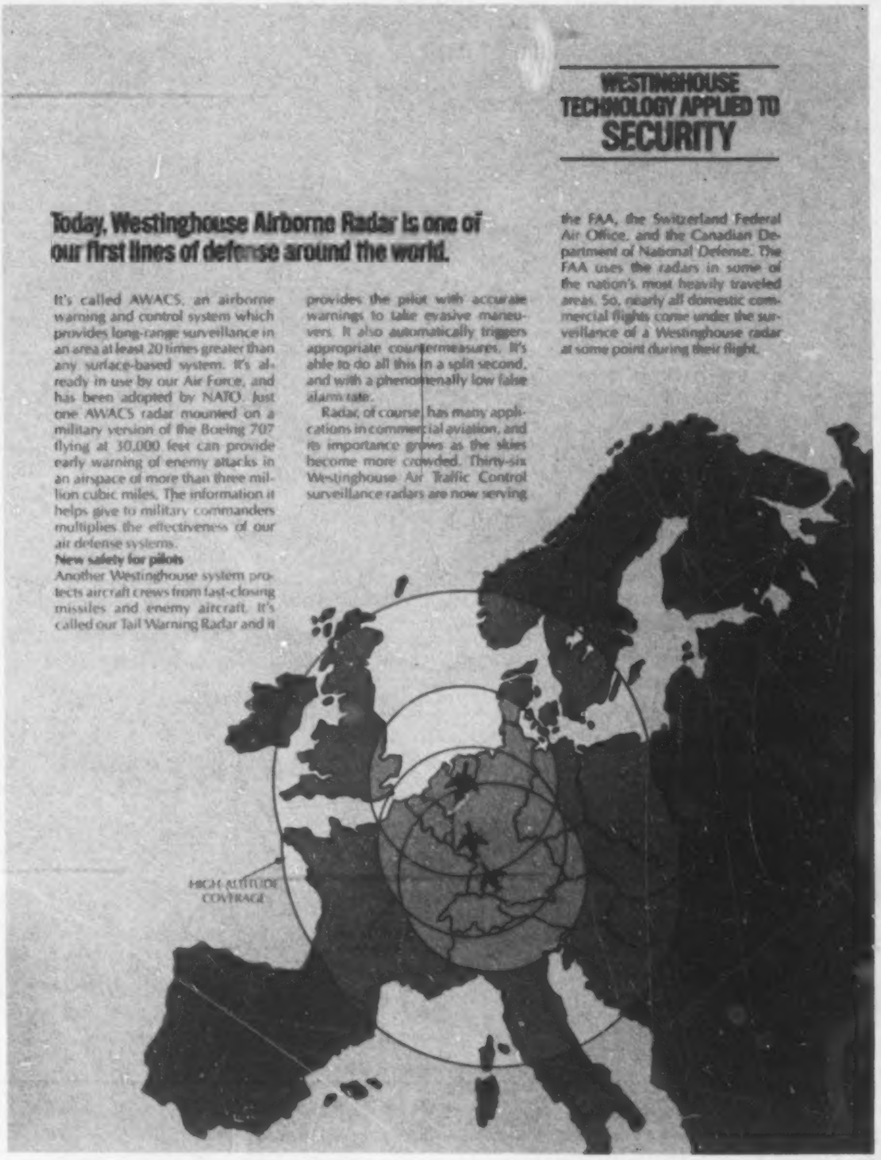
Clean gas from coal

Westinghouse has pioneered in coal gasification technology. Over the last decade we have developed a process to turn coal into a clean gas for power generation, and for industrial or synthetic natural gas applications. The process has the advantage that it can use virtually any type of coal, soft coal or hard coal. The environmental impact is minimal, regardless of the coal's moisture, sulphur, or ash content. With continued technical progress, Westinghouse coal gasification systems can be in commercial operation by the mid-1980's.

Nuclear technology

Nuclear power remains an economical and safe way of producing electricity. Westinghouse leads in the application of nuclear technology to generate electricity. And we are developing an advanced nuclear plant able to make more fuel than it uses.

A segment of silicon ribbon from the Westinghouse dendritic web process


HIGH ALTITUDE
COVERAGE

WESTINGHOUSE
TECHNOLOGY APPLIED TO
SECURITY

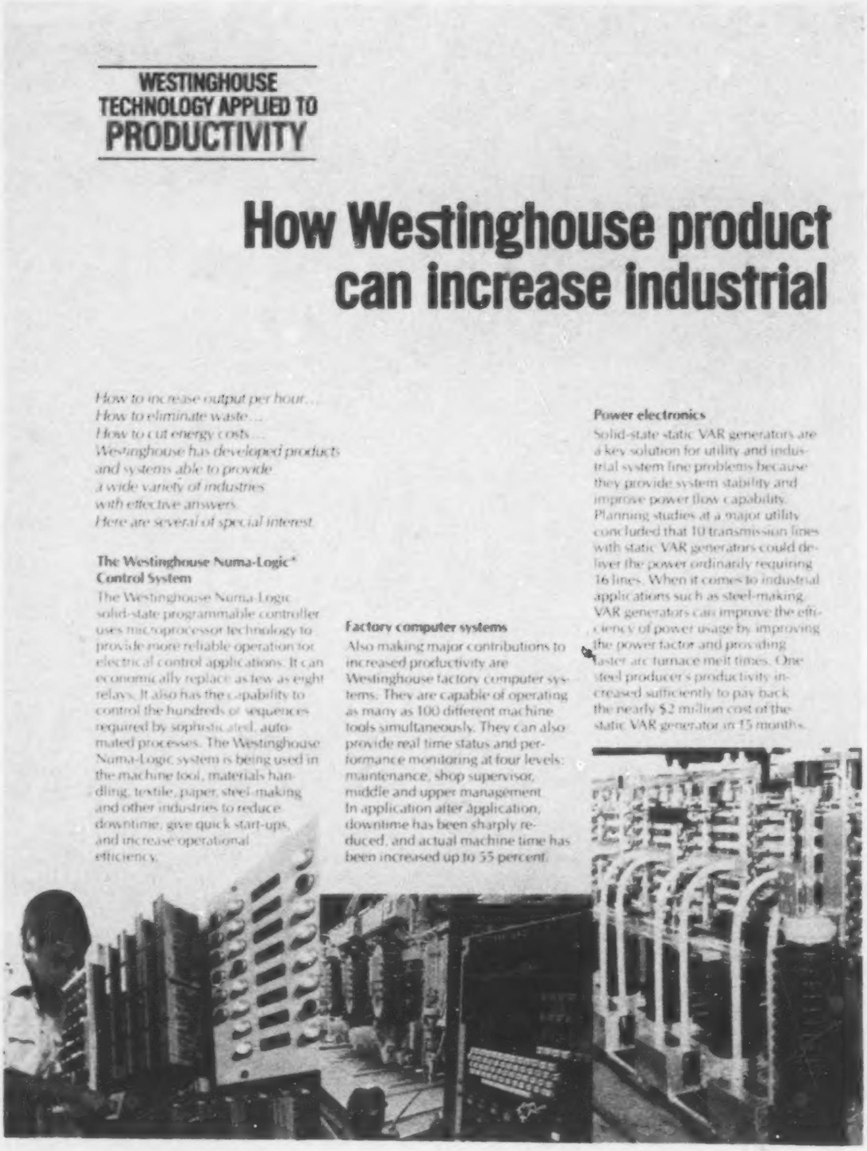
Today, Westinghouse Airborne Radar is one of our first lines of defense around the world.

It's called AWACS, an airborne warning and control system which provides long-range surveillance in an area at least 20 times greater than any surface-based system. It's already in use by our Air Force, and has been adopted by NATO. Just one AWACS radar mounted on a military version of the Boeing 707 flying at 30,000 feet can provide early warning of enemy attacks in an airspace of more than three million cubic miles. The information it helps give to military commanders multiplies the effectiveness of our air defense systems.

New safety for pilots

Another Westinghouse system protects aircraft crews from fast-closing missiles and enemy aircraft. It's called our Tail Warning Radar and it provides the pilot with accurate warnings to take evasive maneuvers. It also automatically triggers appropriate countermeasures. It's able to do all this in a split second, and with a phenomenally low false alarm rate.

Radar, of course, has many applications in commercial aviation, and its importance grows as the skies become more crowded. Thirty-six Westinghouse Air Traffic Control surveillance radars are now serving the FAA, the Switzerland Federal Air Office, and the Canadian Department of National Defense. The FAA uses the radars in some of the nation's most heavily traveled areas. So, nearly all domestic commercial flights come under the surveillance of a Westinghouse radar at some point during their flight.



WESTINGHOUSE
TECHNOLOGY APPLIED TO
PRODUCTIVITY

How Westinghouse product can increase industrial

How to increase output per hour…
How to eliminate waste…
How to cut energy costs…
Westinghouse has developed products
and systems able to provide
a wide variety of industries
with effective answers.
Here are several of special interest.

The Westinghouse Numa-Logic* Control System

The Westinghouse Numa-Logic solid-state programmable controller uses microprocessor technology to provide more reliable operation for electrical control applications. It can economically replace as few as eight relays. It also has the capability to control the hundreds of sequences required by sophisticated, automated processes. The Westinghouse Numa-Logic system is being used in the machine tool, materials handling, textile, paper, steel-making and other industries to reduce downtime, give quick start-ups, and increase operational efficiency.

Factory computer systems

Also making major contributions to increased productivity are Westinghouse factory computer systems. They are capable of operating as many as 100 different machine tools simultaneously. They can also provide real time status and performance monitoring at four levels: maintenance, shop supervisor, middle and upper management. In application after application, downtime has been sharply reduced, and actual machine time has been increased up to 55 percent.

Power electronics

Solid-state static VAR generators are a key solution for utility and industrial system line problems because they provide system stability and improve power flow capability. Planning studies at a major utility concluded that 10 transmission lines with static VAR generators could deliver the power ordinarily requiring 16 lines. When it comes to industrial applications such as steel-making, VAR generators can improve the efficiency of power usage by improving the power factor and providing faster arc furnace melt times. One steel producer's productivity increased sufficiently to pay back the nearly $2 million cost of the static VAR generator in 15 months.

and service technologies productivity today.

Applied Plasma Systems

Because of the skyrocketing costs of fossil fuels used to supply process heat or chemical reactions, many firms are searching for alternatives. The Westinghouse Applied Plasma Systems can efficiently fire high temperature industrial processes, and serve as a central heating device for a myriad of applications such as chemical processes, metals treating, and combustion replacement. This technology is already providing an efficient answer for blast furnaces and direct reduction iron-making processes. It uses a high temperature gas stream to transmit heat. Studies on the upgrading of existing blast furnace facilities demonstrate up to an 80 percent increase in the capacity of the facilities through the application of Applied Plasma Systems.

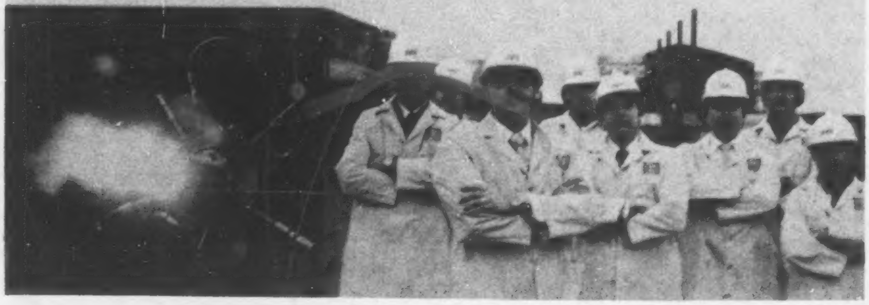
How to minimize downtime... As machines grow more complex, keeping them running takes specialists. To help you maximize productivity, Westinghouse can provide the same technological expertise in services as it does in products.

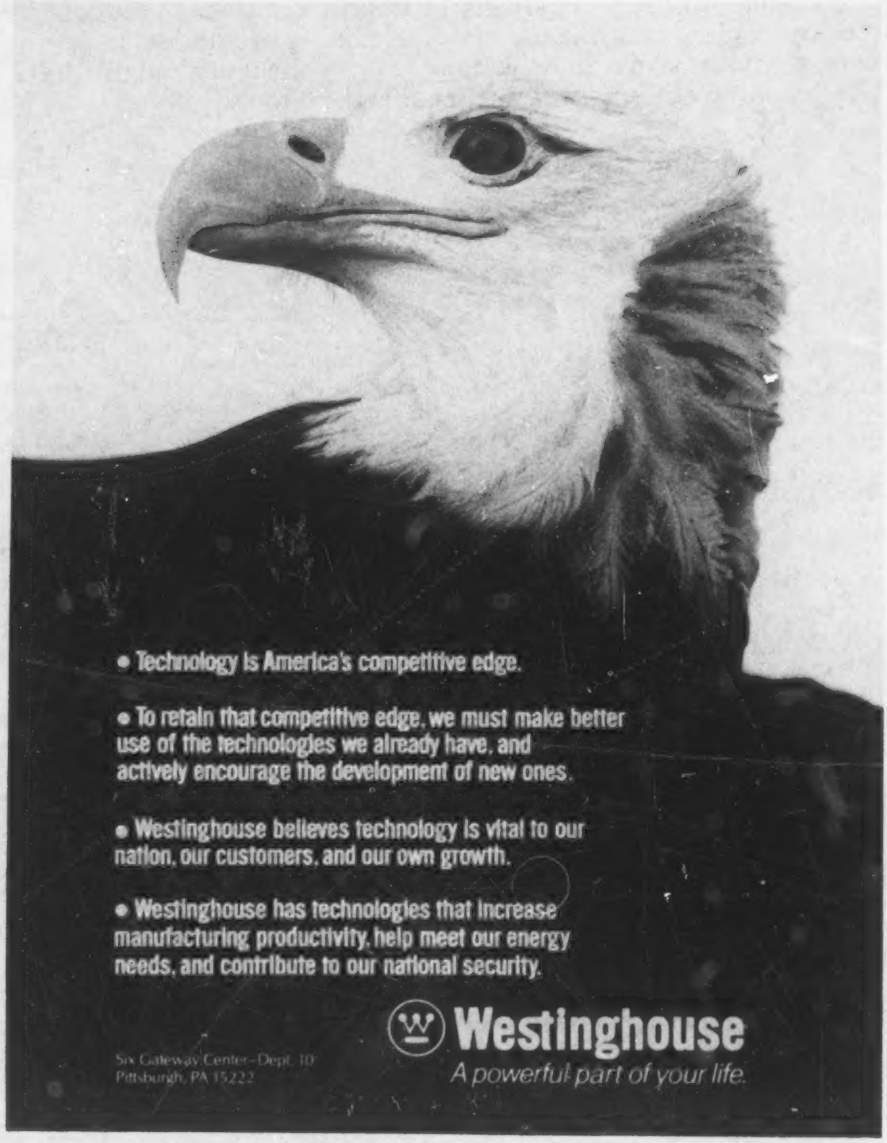
A remarkable worldwide service network

Because Westinghouse engineers, tests, and builds complex products and systems, we have the special skills, trained personnel, and necessary tools to maintain such equipment best; or to repair it in the least amount of time. Available to help you with either maintenance or repair are hundreds of trained Westinghouse field service engineers and specialist mechanics who use the most sophisticated on-site testing and repair equipment. And backing them up is a vast network of repair facilities.

Whether Westinghouse built it or not, we can service and repair almost anything from escalators and elevators, to steam turbines and nuclear power plants. Westinghouse can do an operation analysis and recommend an upgrading program, we can train your operators and service personnel, or we can do continuous monitoring of various operations. Whatever is needed.

Experience has taught us that a regularly planned and scheduled maintenance program greatly increases uptime and saves money. Westinghouse is equipped to provide programmed maintenance on a plant-wide basis. During scheduled shutdowns, a crew of Westinghouse field engineers and technicians can move in to do a complete analysis and top-to-bottom overhaul of your entire facilities.





- Technology is America's competitive edge.
- To retain that competitive edge, we must make better use of the technologies we already have, and actively encourage the development of new ones.
- Westinghouse believes technology is vital to our nation, our customers, and our own growth.
- Westinghouse has technologies that increase manufacturing productivity, help meet our energy needs, and contribute to our national security.

Westinghouse

A powerful part of your life.

Six Gateway Center–Dept. 10
Pittsburgh, PA 15222

Mr. **Danforth**. That concludes my remarks.

I commend you for your efforts to improve national productivity and technological innovation and transfer. I would be happy to answer any questions that you or your colleagues might have.

[The prepared statement of Mr. Danforth follows:]

STATEMENT ON INDUSTRIAL INNOVATION AND TECHNOLOGY BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY OF THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

BY DOUGLAS D. DANFORTH, VICE CHAIRMAN AND CHIEF OPERATING OFFICER, WESTINGHOUSE ELECTRIC CORPORATION

JULY 14, 1981

THANK YOU AND GOOD MORNING.

I AM DOUGLAS D. DANFORTH, VICE CHAIRMAN AND CHIEF OPERATING OFFICER OF WESTINGHOUSE ELECTRIC CORPORATION.

I APPRECIATE YOUR INVITATION TO JOIN IN THIS DISCUSSION OF PUBLIC LAW 96-480, THE "STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980."

MR. SALLOT OF THE SOCIETY OF MANUFACTURING ENGINEERS HAS TOLD ME THAT HE PLANS TO CONCENTRATE HIS REMARKS ON THE IMPLEMENTATION OF THIS LAW. LET ME DEFER TO MR. SALLOT ANY COMMENTS ON THE ACT AND FOCUS MY REMARKS ON THE PROBLEMS AND CHALLENGES FACING INDUSTRIAL INNOVATION AND TECHNOLOGY IN THE UNITED STATES.

I THINK WE AGREE THAT THE FUTURE VITALITY OF AMERICAN INDUSTRY WILL DEPEND ON HOW WELL IT CAN DEVELOP AND APPLY INNOVATIVE SCIENTIFIC AND ENGINEERING IDEAS IN THE WORLD MARKETPLACE.

AFTER ALL, WE'RE LIVING IN AN AGE OF ACCELERATING WORLD-WIDE COMPETITION. BUT AMERICAN INDUSTRY HAS BEEN LOSING SOME OF ITS TECHNOLOGICAL EDGE. OTHER COUNTRIES, MORE DISCIPLINED IN THEIR ECONOMIC POLICIES AND MORE ENLIGHTENED IN THEIR USES OF RESOURCES, HAVE BEEN CATCHING UP TO US.

As a result, our country's share of world exports has declined. We had a 40 percent share in 1950, but only 15 percent last year. Our balance of payments for merchandise has been in the red for the past four years, with deficits averaging $30 billion and more each year.

Foreign manufacturers have been successful in penetrating the U.S. domestic market.

In 1960, the United States imported only 5 percent of its consumer electronic goods. Today, we import 51 percent.

In 1960, we imported only 3 percent of our metal working machine tools. Today, we import over 23 percent.

In 1960, we imported only a fraction of one percent of our electrical components. Today, we import over 20 percent.

THESE MARKET LOSSES -- BOTH AT HOME AND OVERSEAS -- MEAN LOST JOBS, LOST PROFITS, LOST TAXES, LOST OPPORTUNITY.

THEY ARE ESPECIALLY DISCOURAGING WHEN YOU CONSIDER THAT THIS COUNTTTRY HAS BEEN THE WORLD'S LEADER IN TERMS OF INVENTION AND INNOVATION.

TAKE, FOR EXAMPLE, THE NUMBER OF PATENTS ISSUED EACH YEAR IN THE UNITED STATES. THE NUMBER OF DOMESTIC PATENT APPLICATIONS BY AMERICANS HAS BEEN FLAT FOR SEVERAL YEARS.

IN CONTRAST, THE NUMBER FILED HERE BY THOSE FROM OTHER COUNTRIES HAS BEEN RISING. LAST YEAR, ALMOST 38 PERCENT OF THE PATENTS GRANTED WENT TO FOREIGN APPLICANTS, MORE THAN 10 PERCENT OF THEM JAPANESE.

It is an indisputable fact that the United States is dead last in productivity growth rate compared to all modern industrialized nations.

A two-decade era of industrial decline relative to the rest of the industrialized nations of the world has brought us to a point today where much of our industry is less efficient than Japanese, West German, French or Canadian industry.

Most of our consumer electronics are imported. Last year, Japan, alone, produced more cars and trucks than we did in this country.

Any visitor to Japan can quickly see the results of the tremendous investment that country has made in technology and productivity.

I WAS IN JAPAN LAST FALL AND VISITED A NUMBER OF FACTORIES, INCLUDING FIJUTSU FANUC -- A LEADING ROBOT MANUFACTURER IN JAPAN.

WE SAW ROBOTS MAKING PARTS FOR MORE ROBOTS. DURING THE DAY, PEOPLE WORK IN THE FACTORY, MAINTAINING THE MACHINES, MOVING MATERIAL AND PERFORMING SET-UP OPERATIONS. AT NIGHT, THE LIGHTS ARE SHUT OFF WHILE UNATTENDED ROBOTS AND MACHINE TOOLS BUSILY CONTINUE MAKING PARTS FOR MORE ROBOTS.

WE ALSO VISITED YAMAZAKI, A LEADING JAPANESE MACHINE TOOL BUILDER THAT PRODUCES A SOPHISTICATED NUMERICALLY-CONTROLLED MACHINE TOOL, OR MACHINING CENTER, EVERY 40 MINUTES. THEIR MACHINING CENTERS ALSO RUN UNATTENDED ALL NIGHT...IN THE DARK...BUSY MAKING MORE MACHINING CENTERS.

WE TOURED AN AUTOMOBILE PLANT OF TOYOTA THAT PRODUCES ABOUT FOUR TIMES AS MANY ENGINES PER EMPLOYE AS COMPARABLE U.S. ENGINE PLANTS. AND WE TOURED A TOYOTA AUTO ASSEMBLY PLANT WHICH STARTS OUT WITH SHEET STEEL AND PROCESSES IT INTO FINISHED AUTOMOBILES AT THE RATE OF TWO PER MINUTE.

AND BY UTILIZING THEIR INGENIOUS "KAN BAN" PRODUCTION SYSTEM, THEY DO THIS WITH LESS THAN HALF THE PLANT WORK FORCE, ABOUT ONE-THIRD THE FACTORY SPACE, ONE-HALF THE INVESTMENT AND ABOUT ONE-TENTH THE WORK-IN-PROCESS INVENTORY OF COMPARABLE U.S. AUTO PLANTS.

OF EVEN GREATER INTEREST ARE THE FUTURISTIC MANUFACTURING CAPABILITIES JAPAN NOW HAS UNDER DESIGN.

For example, Japan's Ministry of International Trade and Industry (MITI), in cooperation with major Japanese companies, is helping to fund a 60-million-dollar Flexible Machining System complex.

This system will use high energy lasers to manufacture diverse machined parts. This technology could revolutionize machining of small batches of diverse parts by combining the efficiencies and economies of a fully automated production line with the capability of manufacturing small-batch quantities as low as one.

The U.S. has no comparable effort under way.

MITI ALSO IS FUNDING A 140-MILLION-DOLLAR EFFORT TO ADVANCE THE MANUFACTURE OF HIGH-QUALITY INTEGRATED CIRCUITS, AND A 150-MILLION-DOLLAR PROGRAM TO DEVELOP A "SUPER-COMPUTER" THAT WILL BE 66 TIMES FASTER THAN ANYTHING ON THE MARKET TODAY.

BY FAR, THE MOST AMBITIOUS AND EXCITING PROJECT UNDER WAY IN JAPAN, ALSO WITH MITI SPONSORSHIP, IS A "5TH GENERATION COMPUTER" FOR THE POST-1990 PERIOD.

THIS COMPUTER, ACCORDING TO MITI, WOULD HAVE ARTIFICIAL INTELLIGENCE AND THE ABILITY TO SOLVE PROBLEMS WITH NO DIRECT SOFTWARE INSTRUCTION -- MUCH THE WAY A HUMAN BRAIN SOLVES PROBLEMS. IT WILL INCORPORATE VOICE AND PATTERN RECOGNITION INSTEAD OF USING KEYBOARD INPUTS.

THERE ARE NO OTHER KNOWN COMPUTER R & D PROJECTS OF SUCH FAR-REACHING NATURE ANYWHERE ELSE IN THE WORLD.

I CITE THESE FEW EXAMPLES TO SHOW HOW WE -- AS A NATION -- ARE BEING CHALLENGED ON THE TECHNOLOGICAL FRONT. WE STILL HAVE THE LEAD, BUT WE WILL HAVE TO GREATLY INTENSIFY OUR EFFORTS IF WE WANT TO RETAIN THAT LEAD FOR THE BALANCE OF THE CENTURY AND BEYOND.

THERE WILL BE MANY STEPS THAT WE'LL HAVE TO TAKE. IN THE TIME I HAVE THIS MORNING, LET ME MENTION JUST THREE.

FIRST, WE'LL HAVE TO INCREASE BOTH INNOVATION AND PRODUCTIVITY -- STIMULATING INNOVATION AT OUR RESEARCH LABS, AT OUR UNIVERSITIES AND IN OUR INDUSTRIES, AND IMPROVING PRODUCTIVITY IN OUR WORK FORCE.

In support of this effort, Westinghouse is the primary sponsor of "Factory of the Future" projects at Carnegie-Mellon University's Robotics Institute in Pittsburgh. This Institute was established to bring the university's expertise to bear upon the problem of increasing national industrial productivity and technology.

We've also undertaken a major effort to stimulate innovation among our engineers. Senior management early this year established an Engineering Advisory Council. Its assignment is to recommend to management new policies and actions that will strengthen the Corporation's technological leadership.

THIS COUNCIL ALSO WILL SPONSOR SPECIFIC ACTIVITIES DESIGNED TO STIMULATE INNOVATION, SUCH AS EDUCATIONAL COURSES, RECOGNITION PROGRAMS AND COMMUNICATION PROJECTS THAT ENCOURAGE THE EXCHANGE OF TECHNICAL INFORMATION.

AND, WE'VE ALSO CREATED THE POSITION OF VICE-PRESIDENT FOR CORPORATE PRODUCTIVITY. ONE OF HIS RESPONSIBILITIES IS TO DIRECT OUR NEW PRODUCTIVITY CENTER IN PITTSBURGH, WHERE NEW CONCEPTS ARE BEING EVALUATED TO ADVANCE THE STATE-OF-THE-ART IN PRODUCTIVITY IMPROVEMENT METHODS.

WE ESTABLISHED THIS CENTER AS PART OF A MAJOR EFFORT LAUNCHED AT WESTINGHOUSE IN 1979 TO IMPROVE PRODUCTIVITY. SINCE THEN, OUR CORPORATE PRODUCTIVITY HAS CLIMBED ABOUT 12 PERCENT. OUR CORPORATE GOAL IS TO BOOST PRODUCTIVITY BY AT LEAST 70 PERCENT BEFORE THE END OF THIS DECADE.

THESE ACTIVITIES AND OBJECTIVES ARE IN COMPLETE ACCORD WITH THE STATED PURPOSE OF THE STEVENSON-WYDLER ACT TO STIMULATE TECHNOLOGY.

BUT INNOVATION AND TECHNOLOGICAL ADVANCEMENT ARE EXPENSIVE. A SECOND REQUIREMENT, THEREFORE, WILL BE TO ENCOURAGE AND PROVIDE MORE CAPITAL INVESTMENT. THIS CAPITAL IS NEEDED FOR NEW FACILITIES AND PRODUCTIVITY-IMPROVING EQUIPMENT AND FOR REPLACING OBSOLETE EQUIPMENT IN FACTORIES AND OFFICES.

THE UNITED STATES INVENTED SUCH THINGS AS MACHINING CENTERS, NUMERICALLY-CONTROLLED MACHINES AND ROBOTS -- AND ESSENTIALLY ALL THE OTHER ITEMS NEEDED FOR AN AUTOMATED FACTORY.

The reason we are losing out to foreign industry is not the lack of inventive genius, but the lack of available capital for adequate R & D and modernization expenditures.

Today, equipment in the average U.S. plant is 20 years old -- eight years older than the equivalent West German plant and more than 10 years older than the equivalent Japanese plant. This is because both Germany and Japan have been reinvesting more of their Gross National Product for modern plants and equipment.

In research and development, the ratio of our expenditures to GNP has also lagged. It decreased nearly 24 percent over the last 15 years. A recent government report noted that regulatory compliance procedures for some industries were consuming up to 40 percent of the average national R & D expenditures.

We need to reverse this trend. Government and industry must continue the process that's now under way of working together to eliminate regulatory and taxation barriers -- barriers that have limited plant modernization and R & D investments. Our national policy should be one of encouraging these investments.

The third -- and most important -- element in promoting more U.S. technological innovation concerns people. We must be sure that we use the capabilities and potential of employes to the fullest.

As we move to the Office- and the Factory-of-the-Future, we will have to pay more attention to the needs of the individual workers.

THIS MEANS OPENING COMMUNICATION CHANNELS BETWEEN EMPLOYE AND EMPLOYER; IT MEANS MAKING PEOPLE FEEL GOOD ABOUT THEIR JOBS AGAIN; IT MEANS TAPPING ONE OF OUR MOST UNDERUTILIZED RESOURCES -- PEOPLE.

ONE OF THE SEVERAL WAYS WE'VE STARTED TAPPING THIS CREATIVITY AT WESTINGHOUSE IS THROUGH OUR QUALITY CIRCLES PROGRAM.

IN A QUALITY CIRCLE, SMALL GROUPS OF PRODUCTION, ADMINISTRATIVE OR SERVICE EMPLOYES VOLUNTARILY GET TOGETHER FOR ABOUT AN HOUR EACH WEEK TO IDENTIFY AND SOLVE JOB-RELATED PROBLEMS. THESE MIGHT BE RELATED TO QUALITY, PRODUCTIVITY, SAFETY OR EVEN THE QUALITY OF THEIR WORKING LIFE.

The members of the Quality Circles come up with their own solutions and then present them to their management team, which is ready and anxious to implement all good ideas.

We now have more than 700 Quality Circles with more than 7,000 employes participating at some 150 Westinghouse locations. By the end of the year, we expect to have well over 10,000 people involved in the Quality Circles program.

We've found that when employes are ASKED what to do instead of being TOLD what to do, they respond to the challenge with good ideas. They become more innovative, more inventive. Morale goes up -- and with it the team spirit that motivates employes to be more productive.

Mr. Chairman, my company has been in the technology business for nearly a century. We think it is the key to the world marketplace. If we want to maintain America's competitive edge, we must make better use of present technologies and encourage new ones.

Concentration on achieving these goals is an essential next step for the Congress and this Administration following the important decisions on the federal budget and tax issues.

I have with me this morning for each of the members a copy of a new eight-page pamphlet on "Technology" which we've sent to leaders in American industry. With your permission, I would like to offer this pamphlet for the record.

Mr. Chairman, that concludes my remarks. I commend you for your efforts to improve national productivity and technological innovation. I'd be happy to discuss these efforts with you further as time permits.

Thank you.

Mr. Walgren. Thank you very much, Mr. Danforth, for your participation and presentation.

I have been impressed, of course, with Westinghouse, which is one of our major companies. And if we are to succeed, we have got to find the strength to succeed in those companies.

In visiting your advanced energy effort out on Route 51 and seeing, particularly, the silicon ribbon produced by the new process that you have developed at Westinghouse, which results in an exponential lowering of costs for photovoltaic cells, I was very impressed with Westinghouse's contribution. Is the silicon ribbon, produced by the new process at Westinghouse, covered in the pamphlet?

Mr. Danforth. Yes, it is.

Mr. Walgren. A very important contribution, among others, so we certainly appreciate that.

I'd like to recognize Mr. Ertel at this point.

Mr. Ertel. Thank you, Mr. Chairman. I appreciate your recognizing me.

Mr. Danforth, I was impressed by your statement and your concise analysis of our research and development problems. I really don't have any questions, but I do agree with what you said and appreciate your comment.

Mr. Danforth. Thank you.

Mr. Walgren. I recognize Mr. Watkins at this point.

Mr. Watkins. I don't have any particular questions. I just want to commend you for your testimony, and for what your company is doing, and also for the fact that you are working with quality circles now. I was very enlightened.

Two-thirds of the inventions don't come from the Fortune 500; they're, rather, from the farmer, the rancher, or the small businessman or skilled worker. And getting skilled workers together and giving them good motivation, I think as you have, the results are going to be tremendous. And I commend you for that.

Mr. Danforth. Thank you.

And I think sometimes, Mr. Chairman, the administration and Congress underestimate the willingness of private industry to share their experiences with others. And I think that is a great untapped national resource that is often overlooked.

We receive visits every week from people in other industries. We visit their plants, and I rarely make a visit that I don't come away with fresh ideas. And I'm sure my colleagues have had the same experience.

Mr. Watkins. It's a tremendous program. The only problem I have is I don't have Westinghouse in my district.

Mr. Danforth. I see. Well, let's work on that.

Mr. Watkins. I'm from a rural, depressed area. And really, we don't have a private sector there to do the job. And this is where I developed an interest in trying to bring forth those new innovative technological ideas and to stimulate industrial growth. It is rough in a rural, depressed area of the country. A company will not come and locate a plant there if you don't have medical and cultural institutions. And if you don't have them, you can't get them, you know.

So, I am going back to the grass roots, trying to start productivity by stimulating private sector interest in a rural, depressed area of this country. I commend your efforts across the Nation with your plants.

And if you would like to look at a location like that, it would make it a lot easier.

Mr. DANFORTH. I heard your comments on the incredible gains that agriculture had made, and they really have. And I'm an amateur agriculturist. I'm not a professional like yourself, but I have a small farm south of Pittsburgh and it is amazing what has happened in the last 50 years in the agricultural sector of our economy and what inventions and new equipment have been able to permit one man to do on a rather large farm, and industry has done similar things. But we have a long way to go. Our rate of improvement has slowed down in the last decade, as we all know from reading statistics.

Mr. WATKINS. Thank you.

Mr. ERTEL. Will the gentleman yield for a moment?

I take back my statement that I have no questions, because you decided some for me. I happen to be from central Pennsylvania, and Westinghouse, of course, being in western Pennsylvania, we would like to invite you to move a little bit east. [Laughter.]

Mr. DANFORTH. Thank you.

We have a plant in Gettysburg. Is that your area?

Mr. ERTEL. That's south. I want you to move north. [Laughter.] I understand you have 85 facilities or something like that in Pennsylvania.

Mr. DANFORTH. Something like that, yes.

Mr. ERTEL. I just want you to know that not one of them is in the central Pennsylvania area which is called the 17th Congressional District. We will be happy to have you any time.

Now, if I might turn to something else, I was looking at your graph here in your publication you handed out. And you show U.S. patents, number of applications filed, and show that in 1960 we had 79,500, and in 1978, 100,000.

I happen to be interested in patent policy and this graph caught my eye. Senator Schmitt and I will probably be introducing a companion bill here in the near future. We have been working on it for some time. In fact, we worked together in the last Congress on some patent legislation, and specifically a uniform Federal patent system to transfer information and part of the technology transfer into the private sector.

When we do grant applications and so on, the United States reserves the right to the patent. And generally then, when they keep the patent, we find it winds up on the shelf and there's very little utilization of the patent.

We are concerned about allowing the one who is the developer of the technology to either have ownership of the patent or make him licensed and require certain things that they would do.

So with that as sort of a background, those U.S. patents are issued. How many of those are being issued to American companies and how many are U.S. patent applications by foreign companies coming in with a foreign patent, to ask for a U.S. patent? Do you have any idea at all?

I think it might be a bit misleading to just show U.S. patents when, in fact, we are finding that foreign companies are coming in for patents. And in any case, the United States is doing well; but, in fact, we might be.

Mr. **Danforth**. Yes; that's a good idea. And I really don't have the numbers on that, but it's fairly significant and it could be a bit misleading.

Mr. **Ertel**. I was just wondering. I was looking at that after I read your testimony, and I was kind of curious about it.

I wanted your view on patents and the transfer. I know you're a large Government contractor. How do you view the patent system as it exists today, with the United States reserving those rights on nonexclusivity to the developer? Does that inhibit the development of an idea or patent because they don't have the exclusivity to do the patent, or have they got enough technological advance by having worked on the subject that they will go ahead and invest tremendous sums in research or development dollars to take that idea and bring it in the marketplace? How do you view that?

Mr. **Danforth**. I don't believe that is very restrictive. We are doing this on a continuing basis. We work on development of something—let's say 90 percent of the funds are Federal funds or State funds, and obviously the patent should be retained by the Government up to the point where the program is complete.

And then, in my judgment, they should be made available to the private sector on a licensing basis. In other words, the person that takes the patent has the obligation to license others to use it. I think that the cost to take the patent—the patent is only the first step, and then after a lot of research and development to carry it out on beyond that, where the private sector would be investing 100 percent of its funds, I think that gives enough edge to go forward and take advantage of that development without any further real contribution or subsidy from the Federal Government.

Mr. **Ertel**. I guess I was not clear in my question.

You do the development work?

Mr. **Danforth**. Right.

Mr. **Ertel**. The patents' issue?

Mr. **Danforth**. Right.

Mr. **Ertel**. U.S. Government is the patent holder?

Mr. **Danforth**. Right.

Mr. **Ertel**. Now, at that point, I agree with you there is a tremendous cost to change that from an idea or concept to a commercial product. Something like 90 percent of the cost from there forward; 10 percent is just development of the patent itself, I guess, by averages.

Do you feel there's any need for the private sector to have any kind of exclusivity, such as Westinghouse, so that they can go forward with the 90 percent, without any Government subsidy, that they will go forward with the 90 percent? Or if it's a marginal-type thing, would Westinghouse say, "Well, look, without exclusivity, we're not going to invest that kind of money to go into it," and just let the thing lapse? How does Westinghouse view that?

Mr. **Danforth**. I don't think that's any restriction as far as we are concerned. At least to the best of my knowledge, I know of no development we have been responsible for—that the Government, of course, owns the patent that has impeded us from going forward and using that technology to develop a product or system. There may be some cases, but I don't know of any case.

Mr. **Ertel**. So you don't think there's any need to transfer the patent to the private sector from the Government? The Government could retain the patent and license a multitude of people?

Mr. **Danforth**. I really don't see any need of that. In fact, I don't see, politically, how you could do it. But that's your profession, not mine.

Mr. **Ertel**. Well, you're in the political arena, too, because you're a person, and everybody is in the political arena. But I have some question whether we can transfer a patent without a recoupment provision for Government. We're giving away Government assets, really, or public assets to the private sector, without repayment to the Government.

Mr. **Danforth**. But normally the firm that develops the patent has a many, many-year—let's say a gain on any individual or corporation that would take the patent cold and then develop it. Even if all the information is in the public domain and available, there's a lot of know-how that goes with the development of a patent. So I've not found it restrictive.

Mr. **Ertel**. Very good. Thank you.

Mr. **Walgren**. Thank you, Mr. Ertel.

Let me ask, Mr. Danforth, could you give us sort of a thumbnail sketch of the Center for Robotics at Carnegie-Mellon and how it is funded, and what kind of participation there is in it, and what its prospects seem to be?

Mr. **Danforth**. All right. I think it was just about 2 years ago now that we got together with the administration at Carnegie-Mellon and decided that the formation of a Robotics Institute was very desirable, and we made a contribution of a million dollars to get it started. And we were the sole private sector participant in getting it started.

Since that time, I believe six or seven other firms have been invited to participate and share in the funding and have accepted. We are still, obviously, participating in an aggressive way financially and with people. What we have done is we have taken three or four live leads, live examples, real industrial examples, and asked the university to work on these in the Robotics Institute—and these are fairly sophisticated applications. Our people interface with the university scientists on a regular basis. Very soon, the successful development will be transferred back to Westinghouse, and we will apply them in two or three of our factories.

The university, it's my understanding, is not desirous of having too many participants in this. You know, I'm sure they would welcome a dozen or so. But that's how it got started, and that's where it stands. We're really working on the next generation of robotics, not just the two-axis or three-axis robotics, but robotics with a level of intelligence, as we call it, that have very sophisticated sensing devices that can perform near-human tasks. I hope they will never be able to perform, you know, full human tasks, so they won't need us anymore. But that's how it got started.

Mr. **Walgren**. Well, in a sense then, Westinghouse is doing what the administration witness hoped would broaden the society, where the private sector was able to get involved with the university and engage in basic research over a wide range and focused nature.

I notice in your testimony though that that's not quite how they do it. The Government entity is in there somehow.

It goes back to Wes Watkins' underscoring that agriculture is so productive and yet there's no other sector in America that had a greater governmental research input than the agriculture support program. The same thing is true of the aircraft industry. There were incredible leaps of development in that.

My question is: Is a governmental participation like Japan is engaging in inconsistent with economic recovery that we seem to need in this country?

It's my understanding that the present administration has sort of taken the approach that they do not want to engage in any more centers, no money for the university-based technology centers. In their view, it's contrary to the spirit—and maybe it is. I just get the feeling that science is more neutral in all of this, and there must be a practical judgment that can be made about whether something is beneficial and needed.

I, frankly, get a little apprehensive when I read in Japan the robots are now making robots and the plants are functioning without the lights being on, this sort of thing.

Do we have a governmental contribution to make?

Mr. DANFORTH. I think you do. I think the Government can rightfully serve as a catalyst to make some of these things happen, to see some of these things happen. Each nation, of course, has a different priority and a different need.

Japan, as we know, cannot survive without a strong export capability. We need it, too; but they need it even stronger than we, with almost no resources. They can't feed themselves. They have no minerals, no oil, no gas.

So, setting that aside, MITI and the work they do, they really utilize the private sector to do the work I have described in here. They serve a catalyst, and they get industry leaders together and say, "Do we need such and such a development?"

The private industry carries on the development with academia and with the Government sort of, as I say, serving as a catalyst and the sponsor; and they also do some funding, as I indicated here.

I am not sure that we need the same thing. We need part of the same thing that they are proposing. For example, if they had a coal gasification project that Japan needed, as we are working on in this country, I don't think they would do as we have done as a nation—involve 30 firms, if you will, all independently working on coal gasification.

What they would say is, "Gentlemen, this is a national priority. This is a national need. Let's select four or five firms and have them work together, under the auspices of MITI, to develop this in the nation."

Now, once it's developed, of course, it's farmed off to the private sector, and each goes and does their thing.

We don't do that, and I think here Government can play a role. There's no point in bidding the same thing 50 different ways. If it's a real national priority—and I think productivity is—and this is why I made the remark, "Don't underestimate industry's willingness to share experiences with one another," because industry really is willing to do this.

I have seen it happen amongst my colleagues in other sectors of the industry; so I think the role differs, but there is a governmental role to play, in my opinion. I frankly don't think it requires hundreds of millions of dollars. I don't know really what it requires, but you do have a role to play to serve as a catalyst, as a sponsor.

I read in the proposed bill the question of centers. Well, in effect, we have a center in Pittsburgh, as you well know. Others are using that center, and people are welcome to participate in the center's activities.

So, if this were multiplied, if you will, a hundred different places around the country, I think we'd see some real gains in the productivity area.

Mr. WALGREN. Well, thank you very much.

I'd like to give Mr. Mericle and Mr. Sallot an opportunity to respond in that area, of what the Government's role is. I know Mr. Danforth has to go.

Mrs. Heckler, do you have any questions?

Mrs. HECKLER. I have only one general question. It is very broad, but I feel that it is practical.

I wonder how much direction you can achieve without getting into this whole taboo area in business consciousness—economic planning by Government? It seems to me that we, on the one hand, favor it. I think we should, perhaps, in one field. Yet, we are aghast at the possibility of having this really happen.

I wonder about the role of planning in this, how the target goals would be set by Government, without getting into planning?

Second, what about our antitrust laws? Is there any danger of evading them? Does your system really permit us to legally do what we might have to do in order to assure the fastest, most effective, most productive solution to the problem? Are there constraints on that? Should changes be made? How do you resolve these basic questions?

Mr. DANFORTH. You've hit upon a very key issue, and that has to do with the antitrust limitations that American industry has. Certainly I would in no way advocate that they be changed in a major way.

However, again, you come back to the question of national interests. I think sometimes we are overly restrictive in the application of our antitrust laws, and we seem to, at times, feel that if we tamper with this at all, why the whole thing is going to break down.

Well, I don't feel this way. I think there are those in our industry that, again, if we believed and the Government believed we had a major thing to work on here, in that particular project, we would be exempt from certain segments of the trust laws, I think this would solve the problem.

In international consortiums, this goes on all the time, as you know, where you're bidding a major project overseas in a country like Germany or France. Several participants in that project will bid the job jointly; and that doesn't mean there's a collaboration, it doesn't mean there's conniving, but it means that it may be a $100 million transportation project that's of interest to France. And I think we're going to have more of these things in this country. So I think that area needs examination, without, you know, disassembling the whole system. I don't think that's required.

I mentioned coal gasification. I think that's a classic example. Is that important to the country? I think it is.

Can we afford to have 50 people working on the same thing? I don't think we can. But I think it would require some special treatment if we were to do the thing I suggested.

Mr. ERTEL. Will the gentleman yield for one question?

I think Mrs. Heckler has hit on a very important point, because what you're really talking about, as I am listening to what you are saying, we're talking about economic planning by national government.

For instance, if we put a consortium together for coal gasification of five companies, we were the catalyst and determined that you should go down the road for coal gasification—now, that's the Japanese system, and they do long-term economic planning there. They have a planning board by their Government.

I would ask you, No. 1: Is it politically possible in this country to do such a thing? Because that raises an ogre. And I would suggest to you the Business Round Table would be in here banging on our cage, the—very dramatically—the chamber of commerce, the National Association of Manufacturers, saying: "Are you taking over the economic planning of the country and excluding, basically, the private sector or limiting the number of people in the private sector who participate?" That would be No. 1.

I think, politically, you've got a real problem, because it's sort of the antithesis of what we think of as the American style of life.

You've got another problem, with Japan being a small country and being basically headed toward the export markets—even though they're a powerful economic force, if they miss it, and there's economic planning in one area, probably recoup that in other markets, in another area in some way.

If we miss, we lose our leadership in that particular area. Somehow we seem to be very chary of losing that leadership.

It doesn't leave a lot of ground or a lot of room for other innovative ideas from outside percolating. And that is what we kind of think is the way things should go in this country. The competition, to some degree, spurs innovation and productivity incentive.

How do you respond to those?

Mr. DANFORTH. Well, that's about five questions.

Mr. ERTEL. I understand that.

Mr. DANFORTH. If it were easy, we wouldn't be having these kind of hearings. But government involving in planning is a broad subject, and you are already involved because there are any number of research grants given by the Government all the time. And obviously, those grants are being given because someone believes that there is an area that's high upon the national interest scale. And it would not be developed by the private sector without public funding. It may be a long shot; it may be something that's of a very special nature. This goes on all the time.

A very, very large portion of the Federal budget goes into these kinds of things. So whether you call this planning or not, I don't know. It is involvement, and that's kind of the thing that I'm talking about, because the chairman asked, "Is there a role here?"—and I think there is a role here for the Government to play.

It's very sensitive with the round table, and I realize this, but we're already there, and I don't think we can assume that the next 20 years are going to be exactly the last 20 years. They're not. And we have to ask ourselves, as a Nation, can we afford to do everything in the future which we have in the past without losing further the industrial race or the productivity race to other countries?

I would be the last to suggest that we violate the individual corporate and individual incentives, because that's made our country great. And if we start tampering with that seriously, why we're on dangerous ground.

But there are national priorities, yes.

Mr. **Walgren**. I couldn't help but wonder, aren't we in a little bit of a different area than we usually associate with the word planning in the technology and innovation area, because what we're really talking about is developing opportunities and certainly not engaging in any negative you shall not type planning?

Rather, in certain areas that seem to present a national lead, at least developing some—and perhaps who'll be the ones that are ultimately picked up—it—you never mandate a pickup, but at least it will be an effort made in that area that might safeguard the national interests.

Mr. **Danforth**. I think that's better put.

Mr. **Ertel**. If the gentlemen will yield.

We've made a national objective of synfuels, and right now we seem to be going the exact opposite. We have just undercut the development of synfuels, and that turnabout has taken place in less than a year, maybe a year and a half.

Now, with that kind of thinking that we're talking about, how do we ever move this country forward, because we are subject to the philosophical changes of administrations, whereas the Japanese, at least in my judgment, seem to have had a consistent philosophical judgment because the same party has been in power in Japan basically since the war. It's been philosophically the same.

So, if you're going to your planning objectives, and it's technological research, which is the forerunner of all economic planning, you don't have to economically plan after you have done it. You may not have said it, but I just wondered how they go down that road?

Mr. **Watkins**. Mr. Chairman, if the gentleman will yield, I've just got to comment here. I've got to leave very shortly.

Mr. **Walgren**. The Chair recognizes Mr. Watkins. Then we want to get these other gentlemen involved in this discussion.

Mr. **Watkins**. We've got to reflect back to agriculture. We didn't narrow it. We scattered it out. But the big factor was we disseminated it after we got it.

Mr. **Danforth**. That's right.

Mr. **Watkins**. We got it out there, and the means of putting it to work and in the ground—the innovations, the technology, the new fertilizers, the hybrid seed. We failed to do that in industry in this country.

You say we talk a great deal and we're willing to disseminate. Who with? Maybe a few of the other Fortune 500. But two thirds of the inventions come from the small people. How do we get that to the small people, the people who do the innovating and bringing new products on? They're even more efficient.

Until we provide for technology transfer to all sectors—and that's what we're trying to do in the Stevenson-Wydler section 11, with the Federal Laboratory Consortium and the other efforts—until we do that, we're not going to get out to the people. Until we get to those kind of people, we're going to continue to lag way behind, because I know 5 percent of the companies spend 80 percent of R. & D. money in this country—five—I think that's not 5 percent—I think you said five of the major companies. I was shocked when I saw that figure.

Mr. **Danforth**. I have to catch an airplane, but you are hitting on a very valid point.

Let me just add, Mr. Chairman, that Westinghouse, Cincinnati Milacron, and others have thousand and thousands of small suppliers, literally thousands of them, and more and more they have access to the kinds of things we're doing to make them better suppliers.

So there is some of that going on—not nearly enough, but it is going to those channels. I would expect my colleagues in other industries are doing the same thing.

Mr. **Walgren**. Thank you very much. Let me turn to the other two witnesses on the panel.

I'm sorry I've gotten so focused on Mr. Danforth.

We have raised some of the questions we can talk about addressing in your testimony, but please feel free to summarize that testimony or respond to it any way you like. We'll be very interested in your responses to the question of the role of planning and whether or not the funding efforts we have taken in these areas has been inconsistent with where we have to go as an economy.

Let me first recognize Mr. Mericle.

Mr. **Mericle**. I think I'll read my statement first and then address some of the questions.

I'm sorry Mr. Watkins had to leave, because I wanted to assure him I, also, am a farmer.

I, obviously, am very pleased to be here today, to have an opportunity to participate in this panel regarding the implementation of the Stevenson-Wydler Act.

As we all know, the act was the congressional response to the widely-perceived realization that American industry no longer enjoys a dominant position in many important areas of technology. The loss of the technological lead, which American industry enjoyed for most of this century, has had very serious consequences. It has been followed by a serious slippage in the competitive standing of U.S. industry in the world economy; and it is also one of the principal factors responsible for the lag in industrial productivity.

Technology is passing through one of its most exciting and innovative periods. The integrated circuit silicon-chips technology has been a virtual revolution. Robotics and intelligent machines are transforming our industrial systems and bringing into actuality the factories of the future.

In telecommunications, in biotechnology, in new energy conversion systems, we see tremendous bursts of innovation and almost unprecedented change.

Now, in all these significant areas, American technology and invention have led the way. At the cutting edge of modern technology, American industrial R. & D. still enjoys a very long lead.

In saying this, I do not wish to deny that a serious technological lag has afflicted many sectors of American industry. But the most pronounced effects of this lag have shown up not in the very, very high technology sector, but in the more mature industries, which have failed to keep up with the most recent innovations.

The point I would like to emphasize is these various technological sectors of American industry have different needs and require somewhat different strategies.

In the most innovative, technologically-intensive industries, our primary purpose should be to maintain, protect, and extend our current lead.

In mature technology industries, on the other hand, we have to reestablish a technological lead.

I stress this distinction between intensive and mature technologies because in many ways it comes up daily in my work. Because of my 20 years' association with Cincinnati Milacron, among other things a leading manufacturer of industrial robotic systems, I have been privileged to witness one of the most exciting developments of modern technology.

My own responsibility as group vice president in this company is for the plastics division, which I helped organize and direct since its inception.

The plastics industry is far from a technologically backward industry. In fact, until very recently, it enjoyed a faster growth rate than the national average. Yes, during the past 15 years, there has been a drastic decline in the U.S. share of the world export plastics market—not only a loss of the export market but an invasion of the domestic market.

There can be no question that there has been a significant erosion in the U.S. share of the world trade in manufacturing and that the problem which the Stevenson-Wydler Act sought to address is a very serious one.

The growing threat of foreign competition has induced considerable alarm and a tendency to overreact, adopting an overly defensive posture. Many have urged that we impose a variety of import quotas and other artificial barriers to the free flow of trade.

From long experience, I know that such solutions immediately put us in a self-defeating position. Import quotas and artificial barriers are tempting because they seem to offer a quick cure to an urgent problem. In the long run, however, this cure is worse than the disease.

The only genuine answer to foreign competition for the world's markets is to advance our own research and development. Increasing effort in this area will naturally lead to an improved technology and superior products. In this way, we can even beat the Japanese.

Let me give you a case in point: I am associated with a company which manufactures acrylic projection lenses for television. As you are aware, the television industry is dominated by names such as Sony, Toshiba, and others. However, through superior technology, our lens has prevailed over all its competition. Currently, we have a large share of the world market for large-screen TV—Japan is our largest customer.

The reason for our success is clear. In Japan, the United States, and throughout the world, a dominant position in the market is established through the production of a superior product. A superior product is, in turn, manufactured only through superior technology.

The Stevenson-Wydler Act sought to encourage an enhanced technological standing for American industry in a variety of ways, but principally through the establishment of generic technology centers. These centers were to undertake research projects which would be of general interest to industry, but which industry was not likely to undertake.

As we know, the funding for the centers has been deleted from the budget for fiscal year 1981, and no allocations for this program has been made in the 1982 budget. The future of the entire generic technology program now seems to be in doubt.

In my view, this was an unwise decision.

I realize that this decision was motivated by our present economic stringency and by the praiseworthy desire to pare Government expenditures as much as possible.

At the same time, undoubtedly, other considerations were also at work. In the past, criticism has been directed at the generic centers concept on the grounds that such centers follow too closely the pure science model. It was felt that industrial innovation required a much greater awareness of, and responsiveness to, market forces.

Undoubtedly, there is much substance to this criticism. At the same time, it is doubtful that the appropriate response to such objections should be the total elimination of the generic technology program.

In my opinion, a more prudent and judicious approach might entail: A considerable downscaling of the program—a much lower level of expenditures than the $220 million envisaged by the act can probably attain significant results; a more cautious beginning, involving fewer centers, at least until we gain considerable experience with their operations; and recasting of the overall concept to assure much stronger ties to industry and a greater awareness of market forces.

It would be unfortunate if we focused attention solely on the funding issue. Instead, we should consider ways and means for realizing the goals of the act which do not require an immediate large-scale infusion of Federal funds.

It is clear that the administration wishes to delegate the major responsibility for this effort to private industry.

I think industry can deliver, provided that: No. 1. Federal Government also participates in this effort, if only in the role of junior partner; No. 2. Congress and the administration put into effect a variety of measures which will increase industry's ability to intensify its R. & D. activity and facilitate cooperation between industry and the universities.

To be effective, such a program should include the following provisions:

One, tax credits for research and development. Current proposals for tax credits limit the credit for research and development to 25 percent for additional salaries incurred over a rolling base period. Such tax credits should be extended to cover outlays on equipment and other facilities, as these often constitute the major consideration involved in any enlargement of R. & D. activity. Tax credits limited to salaries will have a very limited impact.

Passage of legislation establishing an additional 25-percent tax credit for all investment in research and development is highly desirable. The restriction to small businesses, as provided in several bills, should, however, be eliminated. Such limitation has very little to do with technology or innovation.

TOUCHING ON ANTITRUST POLICY

Current antitrust policies have been an important obstacle impeding technological cooperation and research.

The recent "Antitrust Guide on Research Joint Ventures" issued by the Department of Justice constitutes an important first step in the right direction. But it is only a first step and falls far short of what is needed.

We must dispel the atmosphere of fear and hostility which has enveloped industry's efforts to promote joint ventures in research and development.

Large-scale investigations demand close cooperation not only in the stage of pure research, but also in the engineering and development of commmercial products. All industry, irrespective of size, should be able to participate in information transfer and cooperative research, freed of the restrictions imposed by unnecessary legal barriers.

STRATEGIES FOR INDUSTRIAL EXPORTS

A significant improvement in our balance of trade in manufactures and machinery should be a major goal of our export policy.

The Department of Commerce has established advisory groups to assist various export-minded industries. Consideration should be given to the establishment of additional groups to cover all major industries with a significant export potential. The activity of these groups should be widened to include research institutes, industrywide. This would provide a much needed industrial and technological component to the formulation of new export strategies.

In this connection, we should also give consideration to the provision for financial guarantees to major industries engaged in export and industrial development.

The adoption of such a program, freeing larger industries to pursue major research operations, will do much to enhance current industry R. & D.

To enhance industry R. & D., where a concerted effort is most needed, in the mature technology industries, the centers of industrial technology envisioned by the Stevenson-Wydler Act can be of tremendous assistance.

But to be most effective, I would suggest that we give modifications along the following lines:

The centers should be industry oriented rather than technology oriented.

As originally conceived, each center was to be devoted to a particular technology, such as corrosion or powder metallurgy.

Such technology specific centers would operate, in effect, as industrial superlaboratories, in the hope that they would bring about significant breakthroughs.

Experience has shown, however, that the most successful R. & D. organizations, with the best record for promoting industrial innovations, have been industrywide in scope and have not limited themselves overly narrowly to any specific technology.

In general, centers of industrial technology will be most useful in industries where there is a great diversity and in numerous middle-size and small-size companies lacking adequate R. & D. facilities of their own.

Such industries require research/innovation facilities which afford great flexibility, are acutely responsive to market forces, and have the capability to integrate advances from a wide range of available technologies.

To assure awareness of industry needs and a real time concern with market-driven technologies, it is important that:

These centers be free standing, with close links to industry associations, trade groups, professional societies, and engineering schools.

Even during the initial period, funding for these centers should be provided on a matching basis by industry and Government.

Government funds should be gradually phased out within a 5-year period.

This will assure that such centers will be established only in those areas where there is a genuine industry interest and industry support.

Greater emphasis is placed upon the facet of training and education.

Technological innovation is, after all, a people problem. We need many more research people with hands on industrial experience. Too few graduates of U.S. engineering schools go on for advanced training.

Through industrial sabbaticals, industrial fellowships, and ongoing educational activities, the technology centers can advance significantly the technical level of R. & D. engineering staffs and industry management.

But above all, such centers can act as effective agents for promoting cooperation between industry, Government, and academia. We need all segments of our society to become involved in this effort. Technological innovation is too vital a task, too important for the welfare of American society, for anyone to elect to remain on the sidelines.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Mericle follows:]

W. F. Mericle

Testimony at Hearings of the
Subcommittee on Science, Research
and Technology
July 14, 1981

Mr. Chairman and Members of the Committee,

I am very pleased to be here today and to have an opportunity to participate in this panel on the implementation of the Stevenson-Wydler Act. At the same time, I would like to offer more generally some comments on current needs of American technology and some appropriate responses to those needs.

As we all know, the Stevenson-Wydler Act was the Congressional response to the widely perceived realization that American industry no longer enjoys a dominant position in many important areas of technology. The loss of the technological lead, which American industry enjoyed for most of this century, has had very serious consequences. It has been followed by a serious slippage in the competitive standing of U.S. industry in the world economy; and it is also one of the principal factors responsible for the lag in industrial productivity.

It has become customary to attribute this decline to a supposed loss of innovative spirit. "Whatever happened to American ingenuity?" is a cry regularly raised in the press.

Yet, when we examine the situation more closely, an entirely different picture begins to emerge. Technology is passing through one of its most exciting and innovative periods. The integrated circuit silicon-chips technology has wrought a virtual microelectronics revolution. Robotics and intelligent machines are transforming our industrial systems, and bringing into actuality the factories of the future. In telecommunications, in biotechnology, in new energy conversion systems, we see tremendous bursts of innovation, and almost unprecedented change.

In all these significant areas, American technology and invention have led the way. At the cutting edge of modern technology, American industrial R/D still enjoys a very long lead.

In saying this, I do not wish to deny that a serious technological lag has afflicted many sectors of American industry. But the most pronounced effects of this lag have shown up, not in the very high technology sector, but in the more mature industries which have failed to keep up with the most recent innovations.

The point I would like to emphasize is these various technological sectors of American industry have different needs and require somewhat different strategies.

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I stress this distinction between intensive and mature technolgies, because in many ways it comes up daily in my work. Because of my twenty years association with Cincinnati Milacron, among other things a leading manufacturer of industrial robotic systems, I have been privileged to witness one of the most exciting developments of modern technology.

My own responsibility as group vice president in this company is for the Plastics Division, which I helped organize and direct since its inception.

Currently, I serve as the Treasurer of the Society of the Plastics Industry, an organization of almost all the plastics material manufacturing, material processors and plastics machinery companies in the U.S.

The plastics industry is far from a technologically backward industry. In fact, until very recently it enjoyed a faster growth rate than the national average. Yet, during the past fifteen years, there has been a drastic decline in the U.S. share of the world export plastics market. Not only a loss of the export market but an invasion of the domestic market.

There can be no question that there has been a significant erosion in the U.S. share of the world trade in manufacturing, and that the problems which the Stevenson-Wydler Act sought to address is a very serious one.

The growing threat of foreign competition has induced considerable alarm, and a tendency to over react, adopting an overly defensive posture. Many have urged that we impose a variety of import quotas, and other artificial barriers to the free flow of trade.

From long experience, I know that such solutions immediately put us in a self-defeating position. Import quotas and artificial barriers are tempting because they seem to offer a quick cure to an urgent problem. In the long run, however, this cure is worse than the disease.

The only genuine answer to foreign competition for the world's markets, is to advance our own research and development. Increasing effort in this area will naturally lead to an improved technology and superior products. In this way we can even beat the Japanese on their own home grounds.

Case in point: I am associated with a company which manufactures acrylic projection lenses for television. As you are aware, the television industry is dominated by names such as Sony, Toshiba, and others. However, through superior technology, our lens has prevailed over all its competition. Currently we have a large share of the world market for large screen T.V. Japan is our largest customer.

The reason for our success is clear. In Japan, the United States, and throughout the world, a dominant position in the market is established through the production of a superior product. A superior product is, in turn, manufactured only through superior technology. And, as survey after survey illustrates, superior technology will carry the same weight as a lower purchase price.

The Stevenson-Wydler Act sought to encourage an enhanced technological standing for American industry in a variety of ways, but principally through the establishment of generic technology centers. These centers were to undertake research projects which would be of general interest to industry, but which industry was not likely to undertake.

As we know, the funding for the centers has been deleted from the budget for fiscal year 1981, and no allocations for this program has been made in the 1982 budget. The future of the entire generic technology program now seems to be in doubt.

In my view, this was an unwise decision.

I realize that this decision was motivated by our present economic stringency, and by the praiseworthy desire to pare government expenditures as much as possible.

At the same time, undoubtedly, other considerations were also at work. In the past, criticism has been directed at the generic centers concept on the grounds that such centers follow too closely the "Pure Science" model. It was felt that industrial innovation required a much greater awareness of, and responsiveness to, market forces.

Undoubtedly, there is much substance to this criticism. At the same time, it is doubtful that the appropriate response to such objections should be the total elimination of the generic technology program.

In my opinion, a much more prudent and judicious approach might entail:

(1) A considerable downscaling of the program. A much lower level of expenditures than the $220 million envisionaged by the Act, can probably attain significant results.

(2) A more cautious beginning involing fewer centers, at least until we gain considerable experience with their operations.

(3) A recasting of the overall concept to assure much stronger ties to industry and a greater awareness of market forces.

It would be unfortunate if we focused attention solely on the funding issue. Instead, we should consider ways and means for realizing the goals of the Stevenson-Wydler Act which do not require an immediate large scale infusion of federal funds.

It is clear that the Administration wishes to delegate the major responsibility for this effort to private industry.

As Willis Shapley wrote in the latest annual AAAS report on the state of R/D: (The Administration) has put industry itself on the spot. It is proceeding to implement a program which will "unleash industry to cure its own ills and get the economy on the track to recovery. Now it will be up to industry to deliver."

I think the proper response is that, yes, industry can deliver provided that:

(1) Federal Government also participate in this effort, if only in the role of junior partner.

(2) Congress and the Administration put into effect a variety of measures which will increase industry's ability to intensify its R/D activity, and facilitate cooperation between industry and the universities.

To be effective, such a program should include the following provisions:

(1) (a) Tax credits for research and development. Current proposals for tax credits limit the credit for research and development to 25 percent for additional salaries incurred over a rolling base period. (HR 3849) Such tax credits should be extended to cover outlays on equipment and other facilities, as these often constitute the major consideration involved in any enlargement of R/D activity. Tax credits limited to salaries will have a very limited impact.

(b) Passage of legislation establishing an additional 25% tax credit for all investment in research and development (S-98) is highly desirable. The restriction to small businesses, as provided in several bills (as in HR 3159) should, however, be eliminated. Such limitation has very little to do with technology or innovation. Where would American technology be without the innovations contributed by, say, IBM, General Electric, or Bell Laboratories.

(2) Anti-Trust Policy

Current anti-trust policies has been an important obstacle impeding technological cooperation and research.

The recent Anti-Trust Guide on Research Joint Ventures issued by the Department of Justice constitutes an important first step in the right direction. But it is nly a first step and falls far short of what is needed.

We must dispel the atmosphere of fear and hostility, which has enveloped industry's efforts to promote joint ventures in reserach and development.

Large scale investigations demand close cooperation, not only in the stage of pure research, but also in the engineering and development of commercial products. All industry, irrespective of size, should be able to participate in information transfer and cooperative research, freed of the restrictions imposed by unnecessary legal barriers.

(3) New Strategies for Industrial Exports

A significant improvement in our balance of trade in manufactures and machinery should be a major goal of our export policy.

The Department of Commerce has established advisory groups to assist various export-minded industries. Consideration should be given to the establishment of additional groups to cover all major industries with a significant export potential. The activity of these groups should be widened to include research institutes, industry-wide. This would provide a much-needed industrial and technological component to the formulation of new export strategies.

In this connection, we should also give consideration to the provision for financial guarantees to major industries engaged in export and industrial development.

The adoption of such a program, freeing larger industries to pursue major research operations, will do much to enhance current industry R/D.

American industry's record in research and development is much better than generally realized. In the past decade industrial investment in R/D has been steadily increasing in real terms, even allowing for inflation.

Since 1972, it has increased by an estimated 42 percent.

This is a sizable increase, but is it enough? Not if we measure investment in R/D against the expansion of our industrial economy. As measured against gross industrial output, our investment in industrial R/D has fallen sharply (from 2.5% to 1.9%), while West Germany and Japan have registered significant increases.

And most importantly, industrial R/D tends to be concentrated in very few categories. In 1978, five industries accounted for almost 80% of all R/D expenditures. As can be expected, all of these were in the high-technology categories. This disproportion illustrates the segmentation of American technology, to which I have previously referred.

To enhance industry R/D, where a concerted effort is most needed - in the mature technology industries, the centers of industrial technology envisioned by the Stevenson-Wydler Act can be of tremendous assistance.

But to be most effective, I would suggest that we give modifications along the following lines.

(1) The Centers should be industry-oriented rather than technology-oriented.

As originally conceived, each center was to be devoted to a particular technology such as corrosion or powder metallurgy.

Such technology-specific centers would operate in effect, as industrial superlaboratories in the hope that they would bring about significant breakthroughs.

Experience has shown, however, that the most successful R/D organizations, with the best record for promoting industrial innovations, have been industry-wide in scope, and have not limited themselves overly narrowly to any specific technology.

In general, centers of Industrial Technology will be most useful in industries where there is a great diversity, and in numerous middle-size and small size companies lacking adequate R/D facilities of their own.

Such industries require research/innovation facilities which afford great flexibility, are acutely responsive to market forces, and have the capability to integrate advances from a wide range of available technologies.

To assure awareness of industry needs and a real time concern with market-driven technologies, it is important that:

(a) These centers be free-standing, with close links to industry associations, trade groups, professional societies, and engineering schools.

(b) Even during the initial period, funding for these centers should be provided on a matching basis by industry and government.

Government funds should be gradually phased out within a five-year period.

This will assure that such centers will be established only in those areas where there is a genuine industry interest and industry support.

(c) Greater emphasis be placed upon the facet of training and education.

Technological innovation is, after all, a people problem. We need many more research people with hands-on industrial experience. Too few graduates of U.S. engineering schools go on for advanced training.

Through industrial sabbaticals, industrial fellowships and ongoing educational activities, the technology centers can advance significantly the technical level of R/D engineering staffs and industry management.

(d) But above all, such centers can act as effective agents for promoting cooperation between industry, government and academia. We need all segments of our society to become involved in this effort. Technological innovation is too vital a task, too important for the welfare of American society, for anyone to elect to remain on the sidelines.

W. F. Mericle

Mr. WALGREN. Thank you very much, Mr. Mericle.

That's actually specific testimony.

I would like to turn to Mr. Sallot.

Please go ahead with your testimony. Feel free to summarize in any way that you'd like.

Mr. SALLOT. In the interest of time, I will summarize.

I have a statement here that generally outlines the position of the society on the Stevenson-Wydler Act. Attached to it are two very important attachments we would like to put in the record, if we may.

Mr. WALGREN. The statement in full and attachments will be made part of the record and reproduced.

Mr. SALLOT. Thank you.

First of all, We should identify my profile and that of the society so that we understand the role the society played in the development of the act.

For the past 17 years I have served as the director of technical activities for the Society of Manufacturing Engineers. During that period we have been involved in the leading-edge technologies, CAD/CAM, robots finishing, flexible automation, and so on.

Because of that involvement, we have formed major societies (subsidaries) in the areas of CAD/CAM, finishing and robotics, internationally and in the United States.

We have a North American Metal-Working Institute, which has world interface, to keep us up with the research application activities of other nations. We also have an engineering education foundation.

My present position includes the responsibility for those suborganizations, as well as assistance in the transfer of their leading-edge technologies into the everyday working of industry.

To assist in that, the society has a staff of some 300 full-time persons who are involved in the "hands-on," as we choose to deem it, technology transfer activities. Our membership is in excess of 60,000 and cuts across all the functional and administrative levels of the major industries in the United States. They are located in some 230 chapters in continental United States and 19 countries outside.

Our methods of technology transfer and our philosophy of technology transfer is "hands-on." To do this, we associate the technology with the hardware and the software. The process entails some 35 major conferences and expositions in a single year, some 50 major conferences (a good percentage of which are international in scope) about 150 indepth technology treatments, and the allied publications meetings and their activities.

In the course of the present year, the gross income from those activities will exceed $18 million—and I point out to you that that is only information; there is no product involved—and some 300,000 people will take advantage of those activities in one manner or another.

We have had a growth factor of 10 in the last 8 years, which we attribute to the fact we are successfully transferring technology and, further, that American industry out there is interested in learning that technology to improve productivity.

We hold our own in the professional and engineering community; we are member of many of the more important umbrella societies; and we form a major segment of a constituency of about 1.5 million engineers just in the United States alone.

We are not placard-carrying people, but we nonetheless are thoughtful, reasoned, and we do support sound causes.

I'd like to mention some background history. First of all, we have been involved, as an organization, in productivity since 1972, when, on a grant from the National Science Foundation, we sponsored, along with the National Bureau of Standards, the first recognizable, major productivity conference in the United States. It was held in Washington, and was dedicated to the education of all segments involved, including our industrial people and our Government counterparts.

We have been involved with and have had meaningful increasing relationships over many years with the Department of Commerce, the National Bureau of Standards, and the Department of Defense. We assisted the General Accounting Office early on stages, by furnishing technical expertise from our membership to those who did the original studies of productivity, and who pointed out over 8 years ago the oncoming serious problem that we face today. And the problem we face today is very little different than that pointed out 8 years ago.

I would like to speak now to the implementation of the act.

It surprises me a little that I am here to support the implementation of an act that we have already decided to do. And I was equally surprised this morning to hear—as would many of our members, that what we now need is more studies.

We think at this time that we have almost succumbed to the doctrine of preciseness. For 10 years we have been asking: Precisely what is the problem? Precisely how do you measure it and define it? And precisely what should we do about it?

We think that the time has come to forget preciseness and get on with job. And we think that the Stevenson-Wydler Act, the implementation of that act, though some may feel it's flawed, is a good start in that direction.

We would say if you're on the battlefield in the middle of a fight for your life you don't stop to design a new 40-millimeter shell; you use what you have available. We think this is important in today's climate.

Part of my job responsibility has been—along with Mr. Danforth and many other people, to travel the world. I have been to Japan and the countries of Europe visiting factories. The competitive situation, very frankly, is serious. I think we should stop talking about what we think we ought to do, and we ought to start doing it.

In the process we are going to make many mistakes. We have made them in the past, and we're going to make them again.

But for heaven's sake, let's not look back in 5 or 10 years from now from a position of fifth-rate mediocrity, to say to ourselves that back in 1980 and 1981 we lost the battle—we stooped over dollars to pick up pennies. This is the essence of where we are today.

We actively support four phases of the public law. First, we think the public law forms a starting framework for most of the things we should do—and would like to do. For instance, the National Technology Foundation, tax credits for research, funding for industry and, very importantly, the beginnings of a focal point wherein we can begin to emulate the other nations of the world.

It has been said, in the case of Japan and Western Germany who are our leading competitors today, that the reason they are is because in World War II we destroyed their industrial base, and therefore they were able to rebuild, using new technologies.

We submit that's a partial reason; it is not the entire reason.

World War II was over 35 years ago. If you look at the technologies in many of the basic industries in our competitor nations, you'll find them 20 years or less of age. What this tells us is that they rebuilt with newer technology, but then revised that also upward.

By contrast, in many cases in the United States we are still using technologies that served us well in World War II.

When the industrial base of those countries was destroyed—and I don't think this point comes through significantly—we destroyed something else. That was the institutional structure surrounding the industrial base that made it work.

When the industrial base was rebuilt, Japan and West Germany were able to rebuild a structure better suited to what they were doing. This then enabled them to set national goals, to plan to their implementation, and to bring together, in a cohesive fashion, all the elements of their society.

We have not done that. We had a system that for 200 years has served us well, in fact, extremely well. This was the competitive free enterprise system. But we wonder if perhaps that competitive free enterprise system has not gone over the threshold and gone into really, in some cases, a bitter struggle between the segments of our economy, those segments that should be working together. I think you can find many people who would support that.

We therefore think that implementation of the Stevenson-Wydler Act is a step in the direction of eliminating and minimizing that adversary role. It is not going to be easy to bring together an industry, which is suspicious of a Government that—rightly or wrongly—it thinks has not been cooperative with it in the past.

Mininizing that suspicion is not an overnight thing. It has to be, as several have pointed out here today, an evolution. But you've got to start somewhere, and you've got to set up the mechanism in which various components of industry, academia, and Government can begin to work together.

We spoke of national planning earlier. I don't think, politically, a national planning agency in the United States would work. And I don't think, politically, you could do it.

However, it is a generally considered opinion in industry, that if you set up the mechanism whereby people in these segments can be exposed to each other and have the structure to work together, you will then gradually institute a form of planning, which will come from the grassroots level. In that fashion, you will then reach a consensus on what you want to do, and without realizing it, you will emulate the Japanese in their national planning effort.

In the area of technology transfer, my organization has been heavily involved, as I pointed out before, and we think we do an effective job. But then, so do about 35 or 40 other professional societies.

At the present time we think that there is a huge amount of technology in the Federal laboratories that has not seen the light of day. A basic technology that remains could be on the shelf that translated into a product or a process adds little to the wealth of this country and further adds little to the tax base, which many would so widely disburse.

We think that the establishment of the Technology Board, the Center for Information Transfer, and the Center for Utilization of Federal Technology are must items. Somewhere we've got to start to bring that out.

As everybody here this morning has said, the transfer of technology is people-oriented. It is people to people. It is not broadcasting the availability of that technology on the basis of "I've got it, fellows. Come and get it. And now you think about how you're going to use it."

I had a personal experience in robotics several years ago when a gentleman from NASA asked to speak to some of our manufacturers. He arranged the appointment, and he spoke about—guess what—grippers. I groaned because, I thought, grippers are the simplest thing in robotics. These people are going to want to hear high technology, microprocessors, and so forth.

Surprisingly enough, three manufacturers were so interested in the improvement of the design of grippers that they asked for details. Two of them have incorporated those into their robotic arm today. A simple thing but illustrative of how you expose and transfer even the simplest of technologies.

It is our opinion that the Federal Laboratory Consortium has held several very fine workshop meetings on the subject and has now detailed a blueprint for the transference of its technology to the industrial world.

We offer our assistance in that process. We offer—as we have offered to the integrated computer manufacturing program of the Air Force and to the manufacturing technology advisory program of the DOD, at any time, a forum for the leaders of those projects to transfer their technology into our world of industrial manufacturing and processing. We think that's a dimension that has not been fully utilized and it wouldn't cost very much.

The last point, I would like to speak to the cooperative technology program. We have been involved with that program since the idea first germinated. Through our auspices, the bulk of the people that participated in the technology workshops to define the technologies, or helped define the program, defined the generic areas and helped set priorities on them. Many of these people came from our organization, so we have intimate knowledge of it.

We are not certain that the cooperative technology program is perfect, but one of our position papers draws the analogy between the agricultural extension system and the cooperative technology program.

We think it should be reactivated under Stevenson-Wydler Act and funded as a start, in the important direction of technology transfer. While a program of that nature will probably affect the General Motors, the Fords, the Westinghouses, and so forth, the major impact will be out among the 70,000-plus small businesses, companies, members of small industries, who in many cases are the satellite suppliers to the large organizations.

Believe me, we have some 5,000 similar companies that support membership in our society and others as a means of technology transfer and in the interest of being up to date on the latest in research. These companies do not have the resources to go out and determine, first of all, the generic research needed and then support it and put resources into the development of a product.

I think we need to get on with this program and find out what is right, rather than what's wrong with it, and modify it as we go along.

I have been exposed to several different sets of figures that it takes to implement it in all phases. While I would love to have that sum of money personally, I don't think it is a significant factor in the budget considerations at the present time.

One last comment, one last reason we think we should move on with the implementation is to reestablish a relationship with industry. Let's look at what happened.

Industry, in a climate of adversity, with the Clean Air Act, and transportation and safety problems and OPEC crises and so forth, and beset by regulations, was naturally suspicious of any attempt of Government to move out to help.

It was very difficult to get people to cooperate in the development of any kind of a program that would ultimately lead to greater cooperation of the Government, academia, and industry.

It does appear that when we finally came down to the difficult homestretch of having such a program, that the partnership that had been so laboriously established between industry and Government was broken overnight by Government not funding the program.

I think that is about all I have to say, except I wholeheartedly agree with what Senator Schmitt said in almost every case.

Thank you very much.

[The prepared statement of Mr. Sallot follows:]

TESTIMONY

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES, CONGRESS OF THE UNITED STATES
RAYBURN HOUSE OFFICE BUILDING, ROOM 2325
WASHINGTON, D.C.

JULY 14-16, 1981

HEARING -- IMPLEMENTATION OF PUBLIC LAW 96-480 STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

PRESENTED BY:

BERNARD M. SALLOT
DIRECTOR, PROFESSIONAL AND
GOVERNMENTAL ACTIVITIES

SOCIETY OF MANUFACTURING ENGINEERS
COMPUTER AND AUTOMATED SYSTEMS
ASSOCIATION OF SME
ROBOT INSTITUTE OF AMERICA

SOCIETY OF MANUFACTURING ENGINEERS
ONE SME DRIVE
P.O. BOX 930
DEARBORN, MICHIGAN 48128
(313) 271-1500

ERRATA

Refer to:

Page 2	Fourth paragraph, last line, comma after legislative.
Page 6	Fourth paragraph, line 13, "discrimination" should read "dissemination." Line 20 and 21 should read, "Sufficient knowledge is required to develop a profile of the technology information available within the laboratory."
Page 7	First paragraph, line 6, "of" should read "or."
Page 7	Fifth paragraph, line 6, "rom this meeting" should read "from this meeting."
Page 10	Second paragraph, line 19, "review" should read "revise."

Hearing -- Implementation of Public Law 96-480
Stevenson-Wydler Technology Innovation Act of 1980

Presented By: Bernard M. Sallot -- July 14-16, 1981
Society of Manufacturing Engineers

IMPLEMENTATION OF PUBLIC LAW 96-480
STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

BACKGROUND OF THE SOCIETY OF MANUFACTURING ENGINEERS

Mr. Chairman -- Honorable Subcommittee Members:

My name is Bernard M. Sallot and I am pleased to present this statement on behalf of the Society of Manufacturing Engineers, its affiliated associations and societies, as well as the Robot Institute of America (RIA), founded and managed by the Society as a separate organization.

The affiliated and associated societies of the Society of Manufacturing Engineers are:

a. The Computer and Automated Systems Association of SME -- (CASA/SME)

b. The Association for Finishing Processes of SME-- (AFP/SME)

c. The Robotics International of SME-- (RI/SME)

d. The North American Metalworking Research Institute of SME-- (NAMRI/SME)

e. The SME Manufacturing Engineering Education Foundation

The Society, which celebrates its Golden Anniversary in 1982, has well over 60,000 members, the bulk of whom are distributed in approximately 240 chapters in the United States, and the balance in 25 countries outside the continental United States. These members are in all functional and administrative levels of executive, engineering, technical and corporate management positions in all significant industries in the United States (aircraft, aerospace, machine tool, automotive, off-road vehicle and farm implement, to mention a few.) They are the engineers who apply technology to the design and improvement of production processes in industrial manufacturing.

The SME family of organizations has as its specific goal:

> "to advance scientific knowledge in the field of manufacturing engineering, and to apply its resources to research, writing, publishing and disseminating information."

The philosophy of "hands on" technology transfer is the major means of accomplishing the above goal. The Society defines "hands on" technology as a person-to-person relationship, taking place at its conferences, conferences/educational expositions, application oriented technical papers and publications. These programs bring to the manufacturing engineer routinely the latest in leading edge technology, both hard and soft, and permit interchange between him and those who researched, designed, engineered, built, or used it.

During the current year, in excess of 300,000 people will attend the 35 educational expositions, 47 major national and international conferences, and some 150 in-depth technology educational sessions. Because the industrial world recognizes "hands on" technology transfer as the most significant means of quick increases in productivity, the Society has seen a growth factor of well over 10 times in the last 8 years. All the basic technology in the world serves no one unless it is turned into useful products or processes. Other professional engineering societies have seen similar growth patterns.

The Society of Manufacturing Engineers is a founding member of the American Association of Engineering Societies (AAES), a member of the National Society of Professional Engineers Liaison Group (NSPE), the Federation of Materials Societies (FMS), the American Society for Engineering Education (ASEE), the Accreditation Board for Engineering and Technology, Inc. (ABET), and others, along with various international affiliations.

All in all, the Society members help to form a scientific and engineering community that represents a total constituency of approximately 1.5 million scientists, engineers, and technically oriented people.

The Society, since 1972, when it sponsored the first major conference dealing with productivity in the United States in conjunction with the National Science Foundation (NSF) and the National Bureau of Standards (NBS), has had a major dedication to understanding the productivity problem in the United States and to seeking its solution. Major resources have been dedicated, over the decade, to increasing the Society's role in productivity improvement. During this period, the Society has a history of strong interface and cooperative effort with many components of the United States government, including the NSF, the Department of Commerce, the Department of Defense, the General Accounting Office, and its members have provided testimony and background support to input technical information to the decision making process of the U.S. legislative regulatory and executive components.

As part of this transcript, attached are two position papers approved by the SME Board of Director, that spell out the Society's perspective on productivity, as well as support for those programs which it feels will deal most efficiently with the problem. These papers also contain a more detailed Society profile, along with its history of activities in the area of productivity and assistance to the federal government.

These position papers are entitled:

a. "The National Role and Importance of Manufacturing Engineering and Advanced Manufacturing Technology: -- approved May 8, 1978

and . . .

b. "Cooperative Technology--An Action Alternative for Productivity Advancement" -- approved April 30, 1979.

THE BEGINNING OF IMPLEMENTATION

SME is pleased to see that we have moved to the constructive implementation of the Public Law that will enable at least a start to a strategic plan to accomplish a desperately needed improvement in U.S. productivity. It feels that we have more than enough studies, performed by diverse groups and competent people, to define the problem. More preciseness of definition is not needed. As a matter of fact, the U.S. industrial productivity problem has almost succumbed to the "doctrine of preciseness." "Precisely" what is the problem, "precisely" how do we measure it, "precisely" what is the solution? "Preciseness" has become the excuse for non-activity in many quarters. We have looked at the elephant long enough; we better start "chomping" if we wish ultimately to eat it (as the saying goes.)

Some feel that the Public Law is flawed. That may be, but only trial and implementation will affirm or deny that thesis. To us, it represents a base on which other facets of the constructive solution can be built. There are now many bills in both houses to further implement productivity solutions. H.R. 1864, Research Revitalization Act of 1981, along with the proposed measures for the creation of a National Technology Foundation, can now be placed in proper perspective, once Public Law 96-480 has been implemented. Both these latter measures have the support of the engineering community in concept, as largely confirmed by the American Association of Engineering Societies.

STATEMENT IN SUPPORT OF IMPLEMENTATION OF PUBLIC LAW 96-480.

The Society of Manufacturing Engineers, as part of its public responsibility, has actively and aggressively supported the concept of Public Law 96-480, almost from its inception, as Senate bill 1250. It has furnished background information, technical support, as well as encouraged its members to present technical expertise at the various hearings. It has assisted in the definition of the productivity and innovation problem, and suggested and constructively supported those actions intended to represent solutions to the problem. As mentioned above, it has issued two official policy statements in support of the problem definition, suggested solutions and specific support for the Cooperative Technology Program of the Department of Commerce, now terminated for lack of funding, which was known as the "Cogent" program.

Specifically, this statement will speak to those items of the Public Law dealing with the structure necessary to improve the United States productivity trend, and to facilitate the transfer of technology to that same end.

Public Law 96-480 very effectively defines the problem of productivity, and equally effectively assembles the voluminous data gathered to construct the raionale for the preliminary attack on the problem of U.S. productivity.

Specifically, the Society recommends implementation of the following sections of Public Law 96-480:

I. Appointment of personnel as rapidly as possible to the 16 man National Industrial Technology Board, in the Department of Commerce. Activation of this board could materially assist in carrying out the other provisions of the Public Law.

II. Activate, fund, and staff, with all possible speed, the Office of Industrial Technology, in the Department of Commerce. This can serve as a badly needed focal point for the organization and implementation of the U.S. attack on the productivity problem.

III. Establish the Research and Technology Applications Offices in the Federal Laboratories, and the Center for Utilization of Federal Technology. Rapid dissemination of the technology available from the Federal Laboratories could become the backbone of the action plan to revitalize the U.S. industrial base.

IV. Reconstitute and fund the Cooperative Technology Program as the immediate action plan, analogous to the Agricultural Extension Services System, to begin generic technology assistance primarily to the small business entities and individual entrepreneurs in the U.S. industrial base. The Society feels it is regrettable that this program, previously established, was terminated and the staff disbanded by lack of funding.

I & II. NATIONAL INDUSTRIAL TECHNOLOGY BOARD/OFFICE OF INDUSTRIAL TECHNOLOGY

The Law takes a positive step toward providing good, sound input to the Secretary of Commerce on an ongoing basis when it authorizes the appointment of a 16-man National Industrial Technology Board. This demonstrates a sincere desire to be responsive to the needs of the industrial community and to provide communication channels that will, by means of good advice, maintain that communication channel.

The Board needs to be representative of the various sectors of our industrial base. Obviously, it must include persons who have expertise in the social and economic, as well as the political sectors. But in the final analysis, it is the representatives of our industrial base that will be most apt to discern the technologies that are economically viable to the attainment of national and international product and processes in the marketplace. This Board can serve as a bridge between what is good for the national economic goals and the regaining and maintaining of our worldwide competitive position. It can espouse and recommend appropriate actions or considerations for those technologies which will enhance both the national and international goals of the economy. This is something that has all too obviously been lacking in the past. It is equally obvious that our competitor nations seem to have solved this problem of mutual support and priorities for both national and international goals, to the detriment of our competitive position.

The members of this Board can assist in recommending both the projects and the necessary expertise to initially set up the Office of Industrial Technology, assist in the determination of its projects and priorities, and develop that base which will serve as the focal point for the organization and implementation of the U.S. attack on the productivity problem.

The Society of Manufacturing Engineers is extremely complimentary of the fact that the Public Law has been enacted and that it recommends specific constructive actions to be taken. The Society suggests, however, that this is only a start. It feels that once established, this office should form the basis that could transform a variety of largely uncoordinated, fragmented, and scattered programs in the technology areas into programs that would then be coherent, coordinated and understandable to the industrial world. It would become, in this sense, an ongoing means for the catalizing and promotion of applied research and development in the private sector, and could perform long range forecasting of manpower and resource needs. The creation and implementation of this concept has long been espoused by a major portion of the engineering community.

III. UTILIZATION OF FEDERAL TECHNOLOGY

The Society of Manufacturing Engineers concurs with the statement that there is a large, untapped reservoir of both state-of-the-art technology, as well as advanced state-of-the-art technology now existing in the Federal Laboratories, much of which is probably and readily transferable and applicable to the generation of new products and manufacturing processes, or to the updating of already existing products and processes.

Though no concrete data exists to support this contention, we feel the conclusion is justified because a large percentage of our members work for companies and industries whose job it is to, in many cases, advance the state-of-the-art of manufacturing processes. Many of them work in mission-oriented projects, which, as the Public Law states, do not have a mandate to transfer the results of that technology development further in the private sector across industry lines. From time to time, in our programs, we become aware of technologies that appear to be transferable, yet which do not seem to emerge in those products or processes which will help to create additional wealth from the industrial base of the United States.

At the present time, the Air Force Integrated Computer Aided Manufacturing Program (ICAM) is successfully emphasizing and transferring leading-edge technology into areas of manufacturing other than aircraft. The Department of Defense Manufacturing Technology Advisory Group (MTAG) is another example of successful transference. SME has provided major forums for the leaders of both these programs.

We are strongly convinced though, that, again, as the bill says, the institutional mechanism does not exist to further this transference because of the lack of a policy mandate. The Law provides that policy direction, and we recommend proper structures be inplemented to transfer the technology. The authorizaton of the Research and Technology Applications Offices in Federal Laboratories and the Center for Utilizing Federal Technology appear to the Society to be a step in the proper direction toward the institutional structure. We caution, however, that this be kept a lean, cost effective organizational structure, and not a bureaucracy. This statement is meant constructively because these institutions should be totally action-oriented in the discrimination and transfer of technology. The Society feels particularly competent to discuss the transfer of technology, since this is its main dedication in the dissemination of technical information through its "hands on" philosophy of transfer. These new institutions, authorized in the Public Law, require expertise in the Federal Laboratory sufficient enough to relate them to the industrial world outside the laboratory. Sufficient knowledge is required within the laboratory. An equal amount of expertise of the industrial world is required to establish technology "need" profiles in industry which can then be matched in a targeted approach.

The method of simply stating the availability of a technology and broadcasting it on a wholesale basis, hoping that it will generate an idea for use somewhere in the outside world, is far from an effective means of transfer. Better to target one or two significant technologies and see them utilized in a company of industry, by a concentrated effort, than to waste resources broadcasting the availability of a technology from which no results are discernible.

From the knowledge of our members, we feel that those persons involved in the development of technologies in the Federal Laboratories would, by and large, have the expertise to quickly pinpoint some potential industrial uses other then those for which they were developed. The problem then becomes one of effectively marketing the technology.

We feel that mechanisms do exist that can be cost effectively utilized for this purpose. There are the commercial data nets into which a computerized or profiled data base can be introduced. There are also the tremendous opportunities available through the professional, scientific and technical societies, through their conferences, ongoing programs and publications. Above all, competent, targeted marketing is the key to successful technologies transfer.

The Society of Manufacturing Engineers feels that the ultimate in-exposure to a new technology can be gained through the "hands on" type conference and exposition, of which we have approximately 35 in a given year. The exposure traffic, mostly of people looking for new ideas, is quite heavy. Other societies have, to varying degrees, the same capabilities and would be able to assist the laboratories in the determination of what is appropriate for the given discipline. The Society of Manufacturing Engineers would give consideration to offering both exposition space and conference presentation time to experts in the Federal Laboratories to make known, not only the existence of a technology, but the potential uses to which it can be put.

The Federal Laboratories Consortium has done a good job of bringing together a superb group of knowledgeable people to materially assist the technology transfer problem. The initial conference last spring in Asilomar, California, brought together some very knowledgeable and representative people, and the proceedings issued rom this meeting, along with their recommendations, constituted a very fine start to the solution of the problem of technology transfer from the Federal Laboratories to the private industrial sector.

The follow-up meetings at Monterey in October and again in Dayton, Ohio last spring, also constituted major steps. It is our opinion that sufficient data exists at the present time to quickly constitute the institutions contained in the Law and to make them effective in a relatively short period of time.

We cannot emphasize too strongly that the ability to transfer technology from one person to another, from one industry to another, and to industry in general is the quickest and most efficient means we have to bring about discernible changes in our rate of productivity improvement. It is technology that advances our products and processes and causes the creation of additional wealth that makes us a stronger nation and improves our competitive position in world markets. It is a potent tool that we can begin to use now. The Japanese learned to use this tool from us and they have used it well, to our current disadvantage. This is one area where emulation of what they have done should be a positive benefit to us.

IV. COOPERATIVE TECHNOLOGY PROGRAM OF THE DEPARTMENT OF COMMERCE

The Cooperative Technology Program was not a program ill-conceived overnight to respond to a crisis. Rather, it was a well thought out program, adequately studied and researched by components of the government, industry, academia and professional organizations. There is a multitude of good information to support the concept and indicate the means of implementation. Recommendations contained in studies done by the General Accounting Office, the Department of Commerce, the (now terminated) Council on Productivity and Quality of Working Life, all substantially detailed the problem and suggested surprisingly similar, though independently arrived at, solutions.

The Society wishes to make an extremely important point that has not been given the full attention and emphasis it deserves, but which is a major part of the reason why other nations have been able to outdistance us in the fields of productivity and technology transfer.

It is often stated that in World War II the destruction of the industrial base of Japan and West Germany permitted them, with the help of the United States, to rebuild that industrial base using the latest technologies and efficient equipment. Though this is an important factor, it is not the entire story. It is now 35 years since the close of World War II, yet many of the technologies in use in the basic industries in Japan and West Germany are less than 20 years old, though the initial rebuilding took place in the period shortly following World War II. This suggests an initial installation of up-to-date state-of-the-art technology, and a further change to advanced state-of-the-art technology within the past 20 years. So it is not the destruction of the industrial base (instant amortization) alone that has permitted their efficient production and increasing rate of productivity improvement.

The point overlooked is that when the industrial base of these countries was destroyed, the institutional structures necessary to accommodate the old production base, were destroyed along with it. One might say that they no longer served a purpose. Consequently, when the industrial base was rebuilt, to the latest technologies, these countries were able to rebuild their institutional structure to match their new industrial base. They were able to build on the positive aspects of their culture, and to set up an institutional structure that permitted them to plan, set national consensus goals, fund their programs, and target them toward the most efficient use of their resources both in their own and world markets. Particularly in the case of Japan, this accounts for the reason that they are able to successfully achieve national goals in such a short time.

Contrasted to this, the United States system, which has worked so splendidly for us for the past 200 years, has been built on individual free enterprise entrepreneurial concepts with well defined demarcation lines between government, industry, and academia.

As long as this resulted in friendly competitiveness to achieve productive results, it advanced the United States. But when it crossed the threshold to a sometimes almost bitter adversarial relationship among the industrial, governmental, academic sectors, it brought our productivity improvement processes almost to a standstill, and prevented the setting of reasonable national goals and developing the cooperative means to attain them.

The point to this discussion is that we are in the midst of a struggle for the survival of our economic system and hence our standard of living. We have strong nations as economic competitors, who are able to plan and implement those plans because of their culture and new responsive institutional structure. Since we must compete successfully, and since we obviously cannot destroy our institutional structure that prevents cooperative efforts, we must find ways to use components of that existing structure and put them together in such a fashion to achieve the same results as those of Japan and West Germany, with their streamlined structure. The Cooperative Generic Technology Program was an attempt, and we think a fine one, to develop a strategy to attain the same ends as our competitors, to eliminate the adversarial climate, and to attain similar goals within the present institutional structure with minor evolutionary changes. It is now apparent that we must achieve superiority over our competitors by using the means and structures which we have at hand. We cannot review our entire institutional system to parallel our competitors and, thereby, accomplish the same results. This program, under the guidance and direction of the other components authorized by the Public Law, would go a long way toward eliminating the adversary climate, encouraging cooperation, successfully beginning to transfer existing technology into products and processes that will materially increase our wealth, offer material assistance to some 70,000 small businesses scattered throughout the industrial United States, thereby creating growth and employment, maintain our standard of living and, once again, permit us to hold our own in our national and world markets.

The implementation of this program already is well detailed. It has come from the combined efforts of industry, government and academia, is well founded, supported and very credible. We need dwell no further on the details of implementation. It should be added, however, that the time element here is very critical. Japan, West Germany, Norway, Eastern Germany, Czechoslovakia, and the Soviet Union have already embarked on programs to varying degrees to put together the components of their societies to achieve national productivity goals.

One further point needs to be made. The severe problems of productivity became known at a time when the industry/government relationship was at its worst. Recognizing the need for action, with government instituting the action, industry cooperated, albeit reluctantly at first.

The partnership developed, with people in both industry and government open and helpful, working toward the objective of a decreased adversarial relationship and the resultant increase in cooperation toward desireable goals. Industrial partners work largely in a good faith relationship with other partners, and expect the same from government. Having conceived together a largely agreeable institutional approach to the productivity problem, it was government that abruptly terminated the relationship by not funding the program, though supported by legislation, and by disbanding the staff almost overnight. This action has not tended to improve the environment for the fragile industry/government relationship that existed.

The Cooperative Technology program should be reinstated, funded, and staffed as early as possible, in areas already defined. This would strengthen the industry/government/academia relationship and bring the best of our talents and facilities to bear on the productivity improvement problem.

CONCLUSION

The Society of Manufacturing Engineers recommends the implementation of the items contained in Public Law 96-480, as a major start of a program to address the declining productivity rate in the United States.

The Society, having through its members assisted in the development of the concept of the Public Law, will continue to support, as it can, its implementation.

PREFACE

The Society of Manufacturing Engineers, with a membership in excess of 60,000, and a significant segment of an engineering constituency of some 1.5 million scientists and engineers, is dedicated to the improvement of productivity in the United States. It is a major factor in the "hands on" transfer of technology within and among the various areas of the U.S. industrial manufacturing base.

Having played a major and continuing role in the definition of the United States productivity decline, and dedicated major people resources in cooperation with components of government, industry and academia, in the search for solutions, the Society is pleased to see the enactment of Public Law 96-480 as an enabling start of a program to accent and arrest the U.S. productivity decline, and start the long road back to world leadership.

It recommends rapid implementation of the structures and other provisions of the Law as detailed in the following statement.

Specifically, it recommends the following:

1. Prompt appointment of the National Industrial Technology Board.
2. Activating, funding, and staffing of the Office of Industrial Technology in the Department of Commerce.
3. Establishment of the Research and Technology Applications offices in the Federal Laboratories and the Center for Utilization of Federal Technology to start and accelerate the transfer of technology from the Federal Labs to the private industrial sector.
4. Reconstitute, fund, and staff the Cooperative Technology Program as the start of a program to encourage development of generic technology and a cooperative academic/government/industry combined program to tackle the problem of declining the U.S. productivity.

COOPERATIVE TECHNOLOGY--AN ACTION ALTERNATIVE FOR PRODUCTIVITY ADVANCEMENT

Position Paper by:
The Society of Manufacturing Engineers

Approved by the SME Board of Directors
April 30, 1979

COOPERATIVE TECHNOLOGY--AN ACTION ALTERNATIVE FOR PRODUCTIVITY ADVANCEMENT

On May 8, 1978, the Board of Directors of the Society of Manufacturing Engineers (SME) issued a position paper entitled "The National Role and Importance of Manufacturing Engineering and Advanced Manufacturing Technology." This paper confirmed and reinforced the conclusions drawn in earlier studies conducted by the U.S. General Accounting Office. In so doing, it underscored the urgent need for a national commitment to productivity improvement through advanced manufacturing technology. The SME paper also recommended the strengthening of existing federal programs designed to alleviate the problem of declining productivity.

The position taken by SME in this paper was--and is--strongly supported by other technical societies and associations, and by acknowledged authorities on the productivity crisis. It is noteworthy that the SME paper was extensively quoted by the National Center for Productivity and Quality of Working Life in its final report, entitled "Productivity in the Changing World of the 1980's."

A strong--indeed, an undeniable--consensus has emerged. The consensus is that federal support, in one form or another, must be forthcoming if American scientific and technical superiority is to be restored. Further, this scientific and technical superiority is an imperative if the nation is to attain the ancillary benefits of economic growth, an improved competitive posture in the world marketplace, and the technological capabilities necessary to an impregnable national defense.

The consensus is manifest. A consensus as to how government can best be involved is far less explicit. There are two strongly supported alternatives worth noting, however. They are as follows:

- Direct Participation. Federal assistance in technological advance would be given through the funding of basic research through government procurement policies, through stimulation of innovative enterprises, and through assistance in technology transfer and manpower training for low-growth industries.
- Economic Policy. Federal assistance would be given through a national economic policy designed to amplify the incentives and funding for expanded research and development. Included in this policy would be inflation control, tax credits, reduced regulatory constraints, and modification of antitrust and patent policies.

It is the contention of SME that these interrelated problems in productivity and innovation--as well as many of the alternatives for corrective action--have been well identified by industry for nearly a decade. However, the more recent inquiries and investigations have served (1) to clarify the need to coordinate technological advance with national social and economic goals, (2) to identify the industry segments that are not competitive in world markets, and (3) to identify blockages requiring federal policy adjustments.

Additional byproducts of these investigative efforts by Congress, the Department of Commerce, the General Accounting Office, the National Center for Productivity, and the Office of Technology Assessment have been the generation of relevant statistical data, coordinating techniques, and the development of people-skills essential to a continuing federal involvement in this crucial issue.

The present need--and it is a need of utmost urgency--is to establish an organizational mechanism to implement and apply these findings to a positive program for corrective action.

In its 1978 productivity position paper, SME suggested a restructuring of the Department of Commerce. It further suggested that the restructured department could serve as a focal point for affirmative action in implementing the position paper's advanced manufacturing technology program recommendations.

The Society has been encouraged by the Secretary of Commerce's formation of an Industrial Innovation Coordinating Committee charged with responsibility for the development of specific federal policy recommendations. This initiative has also generated a proposal for a Cooperative Technology consortium in which private enterprise, government, and universities would focus on fundamental technologies which underlie a wide range of industrial needs.

The Cooperative Technology Program*, to be administered by the Assistant Secretary of Commerce for Science and Technology, is a positive and potentially meaningful concept aimed at the improvement of industrial productivity. As presently perceived, the Cooperative Technology concept will stimulate action with respect to industry-identified technical needs related to basic or applied research. This research would be in areas of major national interest which are not adequately addressed by the private sector because of industry fragmentation or a lack of market incentive.

Through the Cooperative Technology concept, the government would support, but not totally fund, technical needs which have been identified by industry. These needs would usually be met by applied research carried out at university centers. There are a number of reasons why SME feels that this program should be supported:

1. By requiring cooperation as the basis for continuation, it represents a step toward reducing the adversary relationship between government and industry.

2. The government role in the program is the appropriate one of facilitating private sector efforts. The government acts as a catalyst, but industry provides the financial support.

3. The program provides recognition that productivity improvement is an important national goal.

4. The program recognizes that technological innovation is important to the improvement of productivity.

5. The program will act to strengthen the relationship between industry and the university community.

The Society of Manufacturing Engineers has an established history of contributory involvement in productivity, technological innovation, technology transfer, and cooperative technology in the many fields of manufacturing.[**] On the basis of this experience, the Society is highly supportive of both actions initiated by the Department of Commerce.

Accordingly, SME recommends the passage of satisfactory enabling legislation and encourages a strong national commitment to the new Cooperative Technology concept and organizational approach. SME feels that this form of Federal support of industrial technology advancement would reduce the adversial relationship that exists between government and industry, would provide a catalyst for action to improve productivity through technical innovation, and would strengthen the relationship between industry and the academic community.

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[*] Appendix A--"Cooperative Technology and the Society of Manufacturing Engineers" describes the Cooperative Technology Program as it relates to SME's sphere of interest and responsibility.

[**] Appendix B--"Productivity and the Society of Manufacturing Engineers" outlines SME's historical role and contributions to manufacturing productivity.

Appendix "A", Page 1

COOPERATIVE TECHNOLOGY--AN ACTION ALTERNATIVE FOR PRODUCTIVITY ADVANCEMENT

COOPERATIVE TECHNOLOGY AND THE SOCIETY OF MANUFACTURING ENGINEERS

The application of "cooperative technology activities" to assist or enhance specific industries or to generate new technology to meet specific national goals, does not represent a new Federal experience. It has been, and is being, effectively utilized in many programs within the Departments of Agriculture, Energy, Interior, Defense and Commerce, as well as other independent agencies.

The Manufacturing Technology Program within the Department of Defense is an example most familiar to SME. This program is specifically geared to insure economical and reliable production of defense materials through development of improved manufacturing processes, materials and equipment. SME's thrust is to broadly interpret and apply any major advances in manufacturing technology to the benefit of the private sector.

The National Science Foundation, through which much of the basic research expenditures of the government are channeled, is investing an increasing share of its resources in experimental programs for the application of fundamental science to industry problem-solving through cooperative technology mechanisms.

These programs have not been visibly oriented toward the productivity issue, however. Nor has the traditional governmental approach of investing in basic research, with the expectation that market forces alone will insure productive application, proven sufficient.

In its major role as a medium for technology transfer, the Society finds the greater need to be a new force to more rapidly accelerate the rate of implementation of existing technology in critical areas of the manufacturing sector.

A determination to effectively fill this critical void is clearly evidenced in planning efforts recently initiated by the Office of Science and Technology of the U.S. Department of Commerce. This is reflected in the stated objective of their Cooperative Technology Program:

> ". . . to spur production and accumulation of scientific and technical knowledge essential for industrial investment in the commercial development of critical technologies."

The mechanism for accomplishing this objective is fully compatible with the SME's 1978 position paper on productivity. The Cooperative Technology Program would:

- Increase the leverage of industrial funds by pooling resources to find solutions to common problems.
- Increase R & D funds to the critical level required for broad applicability to industry.
- Increase the capability of universities and technical institutes to support the effective utilization of technology in industry.

The planned mode of operation through Cooperative Technology Centers--industry-controlled but jointly-funded by industry and government--should insure work programs responsive to timely and real commercial needs. Properly executed, this program also has potential for a corrective contribution to an ailing national research and development environment.

Administration of the program, through an expanded function of the National Bureau of Standards, will provide a starting credibility, a multidisciplinary perspective, and a focal point for integration with other related government programs.

The Department of Commerce has already initiated case studies in several technologies being considered for Cooperative Technology Programs. These preliminary studies are being carried out to test industry response, identify current needs and to make cost benefit determinations. These include, among others: (1) welding; (2) industrial coatings; (3) computer aided design; (4) powder metallurgy; (5) semiconductor fabrication; (6) flexible manufacturing; (7) corrosion protection; (8) radiation processing; and (9) composites. All of these are considered to be of significant interest to SME or SME-affiliated societies.

CONCLUSIONS

The Cooperative Technology Program currently under development by the Department of Commerce is perceived as a viable action response to the expressed needs for Federal assistance in the innovation process. Successful implementation, with a stable long-term commitment to the plan concepts, should provide a significant new resource to combat the declining trend of national productivity. The proposed Cooperative Technology Program is fully compatible with, and should reinforce, the current programs and longer-range interests and strategies of the Society of Manufacturing Engineers.

This position recommendation carries with it an implied commitment for continuing application of the Society's resources to this common national purpose, in cooperation with this new medium of implementation. Support by SME is based on the conviction of urgency and need for constructive, as opposed to further investigative, action. The many impediments which must be minimized or eliminated to make this program truly effective, are fully recognized.

In the formative stages of the proposed Cooperative Technology Program, the Society will establish and maintain a close line of communication with the Office of Science and Technology. A diligent effort will be made to assist in their organizing efforts by offering technical expertise and the experience of our organization and membership in project planning and administration.

The short-term goal of this preliminary activity, to be controlled by the SME Technical Council, will be the selection of project alternatives related to the advanced manufacturing engineering needs which most satisfactorily meet federal, industry, and Society criteria.

COOPERATIVE TECHNOLOGY--AN ACTION ALTERNATIVE FOR PRODUCTIVITY ADVANCEMENT

PRODUCTIVITY AND THE SOCIETY OF MANUFACTURING ENGINEERS

THE SOCIETY PROFILE

The Society of Manufacturing Engineers is a professional technical society dedicated to advancing manufacturing technology through the continuing education of manufacturing engineers and managers. The specific goal of the Society is "to advance scientific knowledge in the field of manufacturing engineering and to apply its resources to research, writing, publishing, and disseminating information."

The Society was founded in 1932 as the American Society of Tool Engineers. From 1960 to 1969, it was known as the American Society of Tool and Manufacturing Engineers; in January 1970 it became the Society of Manufacturing Engineers.

The changes in name reflect the evolution of the manufacturing engineering profession, and the growth and increasing sophistication of a technical society that has gained an international reputation for being the most knowledgeable and progressive voice in the field.

The principal on-going activities of the Society include:

- Conferences and Expositions. Engineering conferences and expositions represent the most effective mediums for technology transfer. During 1978, 16 expositions and 32 conferences were held with total attendance exceeding 128,000.

- Educational Programs. 1978 educational activities included 65 three-day programs (clinics, seminars, workshops) devoted to a single subject, with technical paper presentations, problem-solving sessions and plant tours.

  The Society also offers academic course materials on all aspects of manufacturing for individual study or group instruction. These include programmed learning courses, home study courses, correspondence courses, and video-tape training programs.

- Publications. The principal periodical of the Society is MANUFACTURING ENGINEERING, published monthly and directed to the entire manufacturing community. A wide range of other publications deals more specifically with specialties within the broad spectrum of manufacturing engineering. These include the Tool and Manufacturing Engineers Handbook, Robotics Today, and the Manufacturing Data Series, consisting of 24 reference books on specific subjects within manufacturing engineering.

- Technical Divisions. SME's function is to follow and assess the trends and developments in manufacturing; then to interpret, publish and distribute the information. To tap the technical talents of its 50,000 members, SME sponsors 13 Technical Divisions. These are subdivided into 70 technical areas and encompass all of the disciplines of engineering and management in manufacturing. More than 1,000 volunteers contribute their time and talent to provide the technical input for SME's educational programs.

- Associations of SME. To serve the widening technical interests of manufacturing engineers, SME also has created, and serves as headquarters for, several other associations or technical societies. These include the Robot Institute of America (RIA), the Association for Finishing Processes (AFP/SME), the Association of American CIRP Industrial Sponsors (AACIS), and the Computer and Automated Systems Association (CASA/SME).

- Research and Educational Grants. In addition to sponsoring more than 80 student chapters, covering more than 4,000 students at universities and colleges throughout the United States, the Society supports a program of research and educational grants. Its purpose is to promote the development of manufacturing engineering curricula in colleges and universities, to help upgrade the level of instruction where such programs already exist, and to attract an even higher caliber of students to the profession.

  Since 1954, the Society has spent more than a half million dollars to sponsor research and provide capital equipment to educational institutions and to assist in the development of educational curricula.

- Standards. The Society works closely and continuously with the American National Standards Institute, the International Standards Organization, the American National Metric Council, and other national and international organizations. Its purpose is to help establish and maintain the highest possible standards in the field of manufacturing engineering for the benefit of industry and the profession.

  Among the many other organizations with which SME is affiliated are the Association for Cooperation in Engineering, the Engineers Joint Council, the National Council of Engineering Examiners, the American Automatic Controls Council, and the Federation of Materials Societies.

- Certification. Through its Manufacturing Engineering Certification Institute, the Society also certifies Manufacturing Engineers and Technologists for their technical expertise and knowledge acquired through on-the-job experience and informal education. Degreed personnel and registered professional engineers also may become Certified under this program, which was developed with the guidance and endorsement of industry.

THE SOCIETY AND PRODUCTIVITY

The constituency of the Society is primarily engineering professionals and technologists engaged in the manufacture of primary metal products, machinery, electric and electronic equipment, and miscellaneous manufactured products.

Historically, the Society has provided a forum for the expression of concern on various aspects of its members' job environments. Of special importance are the factors that limit growth and the achievement of personal goals. In the late 1960's, an awareness of a diminishing impact of their efforts and dedication to productivity improvement emerged from this forum. The causes, not then fully identified, were believed to be related to factors beyond either individual or management control.

The first responsive action to these concerns led to SME co-sponsorship with the National Science Foundation and the National Bureau of Standards of a "Manufacturing Productivity Conference" in October, 1972. A primary result of this conference was the aggressive application of Society resources to the clarification of problems and the assessment of alternatives for constructive action. Some of the more significant events and actions which occurred as a result of this thrust are as follows:

- Cooperation with the U.S. General Accounting Office in the development of information for their study on "Manufacturing Technology--A Changing Challenge to Improved Productivity." This was further extended to interpretation and dissemination of the study results and conclusions most relevant to the interests of the SME constituency.

- Cooperation with the National Center for Productivity and Quality of Working Life in their continuing efforts to focus public awareness on productivity problems and the influence of federal policies on productivity.

- Active participation in the Department of Defense sponsored Manufacturing Technology Advisory Group Conferences, recognizing that the prime determinant of the strength of our tri-services defense capabilities is highly dependent on the degree of advancement of manufacturing technology.

- Active participation in the Air Force Integrated Computer-Aided Manufacturing Program aimed at the technology required to reduce the metalworking manufacturing process to total automation from initial design to finished product.

- Active support of the robot industry and university institutes in pioneering efforts in promotion of advanced robotic technology. Since 1974, SME has co-sponsored an International Symposium on Industrial Robots on an annual basis.

These participating activities reflect a continuing SME effort to integrate and coordinate government, university, and private industry resources in the development and application of advanced manufacturing systems. They continue to demonstrate the fact that the basic technology, spawned in the massive atomic energy, space, and communication systems investments, are not approaching their potential for optimization and versatile automation of our factories.

A further consequence of this realization has been the internal restructuring of the Society's organization and programming emphasis. These changes have included the following:

- The annual organization and implementation of a comprehensive conference and exposition on Computer Aided Design and Manufacturing (CAD/CAM) since 1972.
- North American Industrial Robot Conference during the years when international conferences are held abroad.
- The formation and incorporation of the Robot Institute of America to strengthen and support robot technology and its application in industry.
- The organization of a new affiliated Computer and Automated Systems Association (CASA/SME) in 1976 to provide a forum for technical dialogue between a variety of engineering disciplines and to serve as an educational vehicle for its membership.
- The formation and incorporation of an Association of American CIRP Industrial Sponsors to provide an independent medium for interchange of research needs and ideas, international technology transfer, and sponsorship of joint research on broad aspects of production engineering.
- The organization and implementation of annual AUTOFACT Conferences and Expositions. These events recognize the ultimate need for integration of the many engineering technologies in robotics, computer applications, numerical control, and automation essential to attainment of the highest productivity goals. It addresses the future needs of an all-encompassing advanced manufacturing technology.
- The formation of an affiliated Association for Finishing Processes (AFP/SME). This new organization was organized specifically to address emerging problems in development or adaptation of finishing systems to comply with volatile emission control, energy conservation, and toxic material handling regulations. It has provided the principal forum for technical information exchange since 1972 with major conferences and seminars on powder coating, radiation curing, water-borne and high solids coatings, and pretreatment technologies.

Stimulation, reinforcement and amplification of these accelerated efforts has been obtained by contracting for independent studies and surveys by established agencies. The first of these, entitled The Manufacturing Engineer--Today and Tomorrow, was conducted by A. D. Little in July, 1968. The principal motivation was the need for forecasting future educational needs, although its strongly signaled the technological changes we are now addressing.

A recent update entitled The Manufacturing Engineer--Past, Present and Future, conducted by Battelle Laboratories in May, 1979, reaffirms and more clearly defines the technological changes occurring in manufacturing while emphasizing the need for educational adaptation.

The Delphi techniques for technological forecasting were applied by the University of Michigan in major studies of the direction of technological change in four areas of specific interest to the Society constituency. These include:

Manufacturing Systems and Material Removal	May 1977
Manufacturing Management and Assembly	May, 1978
Quality Assurance	In process
Computer Aided Manufacturing	In process

CONCLUSIONS

This itemization of SME's expanding involvement in the promotion and application of advanced manufacturing technology reflects the body of thought now emerging as a national awareness. This decade of Society experience represents countless hours of valuable voluntary effort and contributions by engineers and technologists with personal dedication to professional and technological advancement.

It is significant that their independent rationalizations, as reflected in these activities, now converge with the observations and conclusions of industrial leaders, economists, and political planners.

Society efforts to stimulate innovation, to promote the application of advanced technology, and to break down communications barriers among engineers, industry, government, and educational institutions have made modest progress with limited financial resources. Even more significantly, the process has generated broad lines of communication, a credibility and competence base, and an understanding of the implementation problems to effectively contribute to an accelerated national productivity improvement program.

THE NATIONAL ROLE AND IMPORTANCE OF MANUFACTURING ENGINEERING AND ADVANCED MANUFACTURING TECHNOLOGY

Position Paper by:
Society of Manufacturing Engineers'
Government Relations Committee

Approved by the SME Board of Directors
May 8, 1978

SOCIETY OF MANUFACTURING ENGINEERS

Exhibit A

The National Role and Importance of Manufacturing Engineering and Advanced Manufacturing Technology

The Society of Manufacturing Engineers recommends a national commitment to the improvement of productivity through advanced manufacturing technology. The urgency of this recommendation cannot be overstated. Nor can the consequences of our failure to act be ignored without endangering the national economy and the ultimate welfare of the nation. Suggestions as to an appropriate course of action are contained in this paper and in the attached enclosure.

The Analogy of Agriculture. Since its founding more than 200 years ago, the United States has evolved from an agrarian into an urban culture. In 1776, more than 90 percent of the population was involved in agriculture. Today less than 5 percent of the population is associated with agriculture. Despite this decline in numbers, Americans today have a higher per-capita consumption of food than at any time in the nation's history. Further, the variety of foods has increased, and the levels of food stocks exported have risen exponentially. Despite our greater consumption of food and our increasing exports, the abundance is such that the modern farmer must be subsidized as a way of curtailing the amount of land farmed and the size of the crops obtained.

The resounding success of American agriculture begs a question: Can this success be duplicated in industry? The answer, we believe, is yes. This answer derives from an examination of the history of agriculture, a few highlights of which can be briefly summarized as follows:

In 1862 the federal government established the Department of Agriculture. By the Merrill Act--enacted that same year--the federal government established the land-grant college system. This system has, for more than a century, trained countless numbers of young men and women in advanced agriculture technology.

The land-grant colleges also have large experimental stations which conduct important research in agricultural methods and processes. Importantly, the colleges also train government personnel in the latest findings. The government personnel then update the farmers through personal contact and published reports.

Thus the federal government has established a highly effective system through which it continually searches out higher-productivity agricultural methodologies which are then relayed to the actual practitioners in the field. It is a system that has increased the productivity of American agriculture to a point where it is the envy--and the wonder--of the rest of the world.

Application to Industry. The American industrial system, although still the most powerful in the world, is beset with problems which could in the end prove fatal. It is the contention of the Society of Manufacturing Engineers that this malaise can be corrected through the development and utilization of a system similar to the agricultural system previously described. Accordingly, the Society recommends the following:

Exhibit A

1. That the existing federal programs for the development of manufacturing technology be supported and strengthened.

2. That the Department of Commerce be restructured to support and encourage the development of Advanced Manufacturing Technology programs for the improvement of industrial productivity.* This effort should include (a) an examination of the possibility of assisting in the establishment of manufacturing engineering curricula in colleges and high schools, and (b) the funding of research in advanced manufacturing technology and (c) assisting in the transfer of such technology to industry.

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*Enclosure 1 to this paper is a discussion of industrial productivity today.

Enclosure (1), page 1

The National Role and Importance of Manufacturing Engineering and Advanced Manufacturing Technology

The economic health and well-being of an industrial nation goes hand-in-hand with the health and well-being of its manufacturing industries. This is so for two excellent reasons, the first of which is that manufacturing accounts for approximately one-third of the gross national product (GNP) of such nations.

Secondly, manufacturing is the principal wealth-producing activity of modern industrialized nations. Services account for approximately one-half of the gross national product of most industrialized nations, but services are not wealth-producing activities. They depend for their support on the wealth-producers, i.e., the extractive (agriculture and mining) industries, the construction industry, and the manufacturing industry. It can be shown without difficulty that manufacturing accounts for approximately two-thirds of the wealth produced in modern industrial nations.

A Statistical Breakdown. In the case of the United States, the latest available statistics--those for 1974--show that manufacturing accounts for approximately 23 percent of the GNP. The extractive and construction industries account for about 11 percent and services for the remaining 66 percent. From this it follows that manufacturing accounts for about 68 percent of the direct wealth-producing activity of modern America.

Advanced Capabilities--Greater Requirements. The health of a nation's manufacturing industry is measured by its ability to survive and to compete with other nations in the marketplace--its own and the world's. The primary determinant of its health is the quality and sophistication of its manufacturing technology. In amplifying upon this statement, two factors are of paramount importance:

- The Computer. Originally designed for computational and clerical purposes, the digital computer has moved into a position of dominance in modern manufacturing. It is the sine qua non of all manufacturing systems in which automation, control, and optimization of hardware and software are considerations. It can be said that the sophistication of a manufacturing system is directly proportional to its effectiveness in utilizing computer technology.
- Economic and Social Pressures. Powerful economic and social pressures have come to bear on manufacturing in the past decade. For the most part, these pressures are associated with productivity and the growing reluctance of people to work in the manufacturing industry.

Productivity. The decline in manufacturing productivity is a world-wide phenomenon. To assess its impact on the American economy and the economy of the free world in general, the Society of Manufacturing Engineers has studied the productivity and costs statistics for ten Western nations: Belgium, Canada, France, West Germany. Italy, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States. Also studied were the same figures for Japan. These figures are both enlightening and shocking. For example:

> 1965 to 1970. During this period, manufacturing productivity, as measured in output per man-hour, increased at an average annual rate of 6 percent. But manufacturing labor costs, as measured in compensation per man-hour, increased at an average annual rate of 9 percent.

This is an unhealth situation because a negative differential between productivity and labor costs unleashes powerful inflationary forces. But let us now look at the subsequent five years:

> 1970 to 1975. Manufacturing productivity rose at an average annual rate of only 4.5 percent. Manufacturing costs rose at an annual average rate of nearly 21 percent.

And thus we come to the roots of the inflation that has plagued the Western Bloc nations and Japan for the past fifteen years. But before prescribing a cure, let us examine the statistics for the United States alone:

> 1965 to 1970. Manufacturing productivity increased at an annual rate of 2.1 percent. Manufacturing labor costs increased at an average annual rate of 6.0 percent.

> 1970 to 1975. Manufacturing productivity increased at an average rate of 2.0 percent. Manufacturing labor costs increased at an average annual rate of 9.5 percent.

The implications of these figures lead to a single conclusion: That manufacturing costs must be reduced through the increased application of advanced manufacturing technology.

A Proven Concept. The development and application of advanced manufacturing technology has demonstrated its capability to reverse this otherwise disastrous national and international trend. In the field of metalworking manufacturing, prototype computer controlled manufacturing systems are operating on a semi-experimental basis in Japan, West Germany, and the United States. These systems have demonstrated an ability to increase the productivity of batch type parts-making by several hundred percent. Similarly, they have demonstrated their ability to reduce labor costs in such operations by 80 percent and more.

Social Pressures. In most industrialized nations, the percentage of the workforce that is willing to work in manufacturing jobs is constantly shrinking. In the United States the trend has been clearly downward since the end of the Second World War. Professor Daniel Bell of Harvard, who has been studying this trend, cites some interesting and informative statistics on this subject in his book The Coming of the Post Industrial Society.

In the period 1968-1980 Prof. Bell sees the total available workforce in the United States expanding by some 23 percent. The service-producing activities are expected to increase by approximately 31 percent. But the goods-producing activities (the manufacturing industry) will increase by only 9 percent.

Looking backward to the beginning of the trend, in 1947, 30 percent of the workforce in the United States was employed in manufacturing. By 1968 the percentage figure had dropped to 24.9. The Bureau of Labor predicts a dropoff of 22.4 percent by 1980. And Prof. Bell predicts that it will be down to 10 percent by the year 2000.

But it is imperative that the manufacturing industry continue to grow throughout this period, since it is the principal wealth-producing activity of the country. And because the migratory drift of workers away from manufacturing and into the services sector is apparently irreversible, new manufacturing methodologies must be employed. These methodologies will provide an even greater flow of manufactured goods; they will sustain this flow with far fewer people. They will involve computerized systems that are almost completely automated.

The Digital Computer. It is said that the introduction of the digital computer heralded the advent of a new revolution in manufacturing. It is more likely that the entry of the computer to manufacturing marks the beginning of the ultimate and final phase of the Industrial Revolution. These points of view represent philosophical differences that will be resolved by scholars as yet unborn. For our purposes it suffices that the digital computer provides the wherewithal to solve the principal problems outlined in this paper: declining productivity and the growing distaste of people for work in manufacturing systems.

To measure the impact of the computer on manufacturing, and to develop statistically valid data concerning its future impact, the Society of Manufacturing Engineers, in cooperation with The University of Michigan and the National Machine Tool Builders Association, has undertaken a number of Delphi* studies. The first study, published in May, 1977, included the following points in its forecast:

1. By about 1982, approximately 10 percent of the total machine tool production will be used in integrated, computer-controlled manufacturing systems. These systems will be equipped with automated parts handling equipment for workpiece movement through the system. Like the machine tools, the material handling equipment will be under the control of a central computer.

2. By about 1985, computer software systems for the automation and optimization of all steps in manufacturing planning will be used by at least 25 percent of the manufacturing industry. These steps include the development of machining sequences, the selection of the necessary machine tools, clamping, the selection of operational sequences, tool selection, the selection of optimum cutting conditions, and the like.

3. By about 1987, approximately 38 percent of the total manufacturing systems will be equipped with diagnostic sensors and the associated software for detecting and correcting breakdowns in the system.

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*Delphi forecasting is a statistically valid methodology for predicting future events on the basis of current trends. The methodology was developed by the Rand Corporation to answer certain questions related to the national security. Rand's development and subsequent use of Delphi forecasting provided satisfactory answers. Rand's naming of the process for the classical oracle of Delphi must be regarded as classical whimsy.

These points and numerous others made in the Delphi study underscore the fact that the computerization of industry will become an irreversible fact of life before the end of the century. Before this happens, however, certain changes in our approach to the related research and development are mandatory.

A Cooperative Endeavor. Many nations have recognized the two inevitable facts concerning computerized manufacturing. The first is that they must develop systems of the type discussed in this report if they are to survive as world powers. The second fact is that the development of such systems calls for cooperative effort on a national scale. A number of such efforts are now being implemented throughout the world. These efforts are all-inclusive in that they involve cooperative action by the manufacturing industry, universities, government, trade associations and technical societies related to, or affiliated with, the manufacturing industry.

The Japanese Effort. The example provided by Japan is worthy of study and possibly of emulation. Japan has made the development of computerizd manufacturing a national program in which work is divided among the following:

1. Universities. Basic research in a multitude of small projects. Average funding: $30,000 each.
2. Government Laboratories. Applied research in a variety of medium sized projects. Average funding: $300,000 per project.
3. Industrial Companies. Development in a limited number of large projects jointly funded by government and industry. Average funding: $3 million.

The background study, planning and coordination of this work is accomplished through a number of committees. The structures of these committees include representatives from industry, the universities and government. The related organizational and administrative work is accomplished through appropriate trade associations and technical societies. Government and industry share in the necessary funding.

One especially noteworthy result of the Japanese approach is the recent planning of a national program called "Methodology for Unmanned Manufacturing." The purpose of this program is to develop and implement a number of computer-automated and optimized manufacturing plants. The first step in this program is to be the development of a small prototype, scheduled for operation by 1984. The Ministry of International Trade and Industry has contributed $50 million to the funding of this effort, thus giving a testimonial of sorts to the seriousness of the Japanese effort.

Other nations are developing cooperative programs similar to Japan's. The most significant to date are now aborning in West Germany, Norway, East Germany, Czechoslovakia and the Soviet Union.

The Abortive American Effort. Similar attempts to develop a cooperative approach to the automated factory have not fared so well in the United States. A small amount of basic research was being funded by the National Science Foundation. But even this effort, which was small compared to that of our overseas competitors, suffered a serious setback with the dismemberment of the RANN Division of NSF. For it was RANN that provided the necessary support.

Two other items tend to support the contention that there is little or no interest on the part of the federal government in computer-aided and computer-optimized manufacturing. One is the budget cutback for the newly launched Air Force/DOD program on Integrated Computer Aided Manufacturing. Importantly, this cutback came in the program's first full year of operation.

The other item is the fact that the excellent report of the Comptroller General of the United States to the Congress has received virtually no response from that body. And yet the report entitled Manufacturing Technology--A Changing Challenge to Improved Productivity, defines the problem and its consequences in devastating detail.

The Needed American Effort. The wealth-producing function of manufacturing is fundamental to the economic well-being of America. It is an area of human endeavor in which we have been dominant for several generations and one in which our still formidable capabilities have given us a flow of material goods unprecedented in world history. It is an area in which we have functioned superlatively well without government support but with government intervention--much of it unnecessary.

But now the rules of the game are changing, largely because of the growing complexity of technology and the speed with which it is evolving. There was a day--not long ago--when each intelligently managed industry could easily assimilate change and make the necessary adaptations.

But the continuing and rapidly accelerating evolution of industry has now brought us to the gates of the automatic factory. To step inside calls for a greater effort than any one industry can make on its own. We can proceed no further without a cooperative effort in which industry, academia, the federal government and the technical societies join hands--as is now being done in Japan, Norway and West Germany.

The alternative? The rapid decay of American industry and the degeneration of America itself into a small and unimportant industrial backwater. It is an alternative that we need not--and cannot--contemplate.

Policy Document No. 1
March, 1981

The Decline of Productivity and the Resultant Loss of U.S. World Economic and Political Leadership

Robot Insitute of America
One SME Drive
P.O. Box 930
Dearborn, Michigan 48128

Limited quantities of this report are available at no cost from: Robot Institute of America ● P.O. Box 930 ● Dearborn, Michigan 48128

After little more than 200 years of existence the United States faces economic survival challenges from Japan and other nations. Our productivity rate has declined while theirs has gained disproportionately using our technologies, products and know-how. Massive outflow of entire U.S. industries and jobs to these countries has occurred. Our loss of lead will be total in 1990 unless we change our policies, set national goals and change our tax laws and regulations to encourage greater use of technology, accompanied by massive doses of capital to apply it to our industrial system. To do so, we must attain a 4%/year compounded productivity rate. The challenge is horrendous. But we must meet it if we are to survive and regain our world leadership.

Robot Institute of America
Executive Committee:
Stanley J. Polcyn, *President*
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Michael Radeke, *Secretary*
Richard G. Abraham, *Treasurer*
John A. Fulmer, *Past President*
Bernard M. Sallot, *Executive Director*

The Decline of Productivity and the Resultant Loss of U.S. World Economic and Political Leadership

Executive Summary

The purpose of this paper is to explore the decline in U.S. industrial productivity and to assess what can be learned from the productivity successes in Japan and Germany. As the world's most affluent nation, the U.S. is suffering from a negative trend in productivity that can be reversed by:

1) Encouraging industry and government to invest in applied and new technologies.
2) Setting depreciation schedules that are more compatible with the real world of obsolescence. Grant special tax credits for the added risk involved in accepting and installing new technologies.
3) Changing the patent laws to permit individual innovative entrepreneurs to retain adequate proceeds from their inventive efforts. Transferring dormant technologies from the public sector to useful job-creating products and processes in the private sector.
4) Encouraging individual savings and investment.
5) Encouraging, by tax law changes, the formation of small enterprises based on new research and technology (fall off in rate of formation of small firms since tax law changes in 1969 and again in 1976 are almost total).
6) Encouraging development of meaningful interface mechanisms to permit timely in-flow of new foreign technologies to the U.S.
7) Accelerating the development of government policies, legislation, and regulation designed to encourage more effective use of our human resources, through training, education, and recognition of financial support needed for new and evolving skills and technical careers.
8) Streamlining the myriad components of the Government, Executive Branch, Congress, technical and scientific committees, etc., to work more efficiently to identify goals and promote policies leading to the rapid solution of our productivity problem. Terminate endless, time-consuming and self-serving cosmetic debate, and replace it with action and solution-oriented agreemnt.
9) Directing top management in acceptance of the role of new technologies and committing their enterprises to these applications and uses.

THE UNITED STATES AS A WORLD ECONOMIC POWER

The United States, after some 200 years of official existence, has reached a critical point in its growth, facing serious obstacles to further expansion and development.

It is the objective of this report to define our current problem, suggest that a portion of its solution can be met by increasing technology, particularly in robotics, and point out how Japan, our chief economic adversary, has met its own problems and challenges. The paper will suggest that emulation of Japan will ultimately be our most rapid solution to the problem. President Reagan has said that our "current situation borders on the calamitous" and "that we must seek both drastic and positive solutions." Included are the steps necessary, in the opinion of the Robot Institute of America, to regain our lost productivity dominance.

The importance of productivity growth cannot be overstated. It is a contributor to, and an indicator of, the effective annual net growth of the Gross National Product.

THE PRODUCTIVITY PROBLEM

In absolute terms, the United States still leads the rest of the industrialized world in productivity. In terms of productivity growth, an extremely important economic measuring tool, the United States now lags all other industrialized nations.

The importance of productivity growth cannot be overstated. It is a contributor to, and an indicator of, the effective annual net growth of the Gross National Product. Latest Department of Commerce figures show that the rate of growth of U.S. GNP is declining in real terms:

1976	*5.7%*
1977	*4.9%*
1978	*3.9%*
1979	*1.9%*
1980	*2.0%*

If we are to make increasingly severe demands on the GNP—in terms of wage and salary improvements, a growing fixed burden of Social Security, an adequate national defense, the growing cost of environmentalism, and the creation of job opportunity—it follows that the effective real GNP must have at least a corresponding growth to offset their costs. Otherwise, we will be unable to maintain our present standard of living and fail to regain our worldwide competitive position.

Since 1970, the United States productivity growth has declined due to lack of investment capital, diminished research and development, excessive regulation, conflicing taxation policies, misdirected anti-trust policies with punitive and indecisive enforcement, and finally, ineffective technology transfer. These factors have been compounded by our overall fixation on immediate benefit at the expense of long range solid gains in almost every aspect of our political and economic lives. With all this, our obsession with due process has created an adversarial institutional relationship that has rendered it impossible to achieve national policy consensus, set national goals, and agree on reasonable programs to implement them.

The U.S. can no longer afford to delay the acceptance of the productivity challenge.

Only through the efficient creation of agricultural and industrial products can we have the means to maintain our standard of living, world competitive position and be able to distribute wealth for the benefit of the less fortunate in the United States and the rest of the world. The U.S. can no longer afford to delay the acceptance of the productivity challenge. What may have been dismissed as an unfortunate irregularity in economic cycles 5-10 years ago, has become a persistent signal that cannot be further ignored if we wish to have a strong economy and a prosperous nation.

Most critically, we need to design the improvements of productivity as a priority national goal. This will focus the industrial, legislative, academic and public groups on a positive approach that will generate constructive policies, actions, and behavior. We have spent an incredible amount of personal energies and resources in "precise" definition of the problem, attempts to "precisely" measure it, and "precise" solutions amid profuse and voluminous cries over our plight.

Understandably, this has resulted in a climate dominated by policies of restraint, prohibition, regulation, controls, and adversarial litigation as incomplete solutions to the fundamental problem.

The time has come to cease "defining the problem" and adopt positive "bottom line" policies and approaches to achieve a solution.

BACKGROUND

Following World War II, and prior to the current period, inflation (2%-4%) and lack of a continually increasing standard of living was seldom a problem; Why? Because our "productivity" always outdistanced inflation and permitted large increases in our standard of living. The years since the war have generated the fantastic and never before achieved yearly average growth of 3.2%. But it has taken us a mere 12 years (since 1967) to fall to a yearly gain of less than ½ of 1% (1979)—and in the past 12 months to become negative (-2.0). Massive reports by the U.S. General Accounting Office, the Department of Commerce, Congress, the Executive Branch and literally hundreds of organizations and individuals support this conclusion.

The time has come to cease "defining the problem" and adopt positive "bottom line" policies and approaches to achieve a solution.

Exactly paralleling this 10 year period, we have seen:

a) Accelerated inflation at an 18% annual rate, with a 50% decline in the purchasing force of the dollar.

b) Decreased living standards and rising unemployment.

c) Declining capital formation and investment.

Percent of Gross Domestic Product invested annually in plants and equipment is declining rapidly. For 1979 and 1980, it is estimated to be nominal.

1947-1967	3.0%
1967-1973	2.5%
1973-1977	1.3%
1977-present	+ 1.0%

Alarming are the 1978 Department of Commerce figures on new plant and equipment orders:

Nov. 1978	7.4% decline (over year before)
Dec. 1978	3.8% decline (over year before)

Annual capital investment is lagging by comparison with our foreign competitors. (There is a direct correlation between our declining capital investment in new plant and technologies and the increasing number of plant closings and loss of jobs.)

Since the Tax Reform Act of 1976, capital investment per worker has almost vanished in the United States.

Specifically, capital investment per worker in the U.S. is falling rapidly, while capital invested per worker in our competitor nations increases.

	1967	1973	
West Germany	$298	$693	per worker
Japan	$191	$324	per worker
United States	$258	$220	per worker

Since the Tax Reform Act of 1976, capital investment per worker has almost vanished in the United States.

Finally, our source of capital from individual savings is rapidly drying up. To begin with, the rate of personal savings in the U.S. is 3 to 4 times less than in Japan and Germany (Japan averages 20%, the U.S. 5%) and even that rate is declining, caused by the dramatic rise in inflation and the Tax Reform Act of 1976.

Rate of individual savings (U.S.--% of GNP)

1976	7.5%
1977	1.5%
1978	5.3%

New business starts dropped to almost zero in 1979-80. Failure to adopt new technologies and invest massive amounts of capital in new plant, equipment and modernization was directly related to plant closings and loss of jobs.

d) Catastrophic negative trade balances.
e) Continually increasing government transfer payments made from a declining pool of industrial and agricultural wealth.
f) Loss of historical competitive markets causing increased dependence on military rather than economic power to maintain a world leadership position.
g) Forced abdication of leadership positions in basic industries whose technology and growth we founded and fostered.
h) Daily challenges to our world leadership.
i) Chaos in, and almost demolition of, our capital markets, with the resultant worldwide ripple effects.

U.S. plant and institutional structure have produced industrial products for itself and the world on a "catch up" basis with little competitive pressure to emulate either Japan or Germany.

In the past 10 years the following annual rates of productivity growth (1978 figures) have been attained and are increasing among those to whom we have lost leadership:

Productivity Rates—(1978)

Japan	*10.5%*	France	*6.0%*
Netherlands	*7.5%*	West Germany	*5.8%*
Sweden	*7.1%*	Switzerland	*5.3%*
Belgium	*6.5%*	Canada	*4.3%*
Italy	*6.4%*	United States	*3.4%*

In 1979, the U.S. rate was 0.6% and in 1980 a negative 1.9% This supports (and continues) the alarming accumulative trend from 1970-1977.

Accumulated productivity gains—

Japan	*105%*	
Germany	*66%*	
France	*54%*	
United States	*24%*	(for comparison)

The Council of Economic Advisors suggests it will be a hard struggle to return to 1.5% per year up through 1985.

And all present facts indicate that the next 10 years to 1990 is when the United States productivity really goes back—UNLESS WE BEGIN TO TAKE POSITIVE CORRECTIVE ACTIONS.

Our competitor's productivity rate increase of an anemic 1.5% per year for the U.S. is far from enough. It is, in fact, a blue print for catastrophy. We can no longer afford the luxury of talk and study. The United States is no longer the world's most affluent nation.

So far, our figures indicate how we got to the cliff's edge. If we apply the present trends with no correction, using current rates and trends, other nations will surpass us by 1990, still at a diverging trend with the U.S. At that point, our standard of living will have plunged. We will be an ineffective world economy, military power and almost incapable of turning ourselves around.

If we make the reassuring (but not necessarily true) assumption that the rate of increase of these other nations will stabilize because they will have reached the point of diminishing returns, we must still attain the following rates of productivity growth to even equal them.

Needed growth rates for U.S./year
2.5% (or better) by 1982
3.0% (or better) by 1985
4.0% by 1990

And then, just to maintain parity, we need annually compounded 4.0% GNP net growth.

The distruction of physical plants (instant amortization) in Japan and Germany, because of World War II, not only permitted their rebuilding with new facilities, equipment and technologies, but also created new institutional structures to manage them.

If we apply the present trends with no correction, using current rates and trends, other nations will surpass us by 1990, still at a diverging trend in the U.S.

The new and coordinated institutional structures of Japan have permitted nearly instantaneous marshalling of government, financial, industrial and academic resources to the attainment of consensus national and international goals. Japan chose, largely through MITI, goals of enhanced industrial productivity, foremost international trade and economic position among nations, and then mobilized national resources toward their attainment.

CURRENT ENVIRONMENT

U.S. plant and institutional structure have produced industrial products for itself and the world on a "catch up" basis with little competitive pressure to emulate either Japan or Germany. While institutions of Japan and Germany concentrated on national goals, the U.S. institutions became decentralized and divisive, creating an adversarial climate among government, industry, and academia, thus rendering it almost impossible to set consensus goals and strategic plans to achieve them.

The destruction of physical plant (instant amortization) in Japan and Germany, because of World War II, not only permitted their rebuilding with new facilities, equipment and technologies, but also created new institutional structures to manage them.

In the U.S. environment:

1) The Productivity rate is declining rapidly.
2) Capital formation and investment in productive facilities is declining because financial resources are being removed from the control of the private industry sector. (Corporate taxes have increased from 38% to 48% from 1966-1976.) It is almost impossible for new small entrepreneurial ventures to raise capital and create jobs.
3) Average return on investment has decreased from 10% (1965) to 4% (1977). At a 4% rate of return on productive investment, there are many better places for resources with less risk of capital loss.
4) Rate of technology transfer from generic technology to useful products is declining rapidly.
5) Rate of generation of new, useful technology and innovation is decreasing rapidly.
6) Education of people resources in new technology usage and product application lags badly. Worse yet, education of government, industry, and general public leaders for the acceptance of the important role of new technology for the creation of new industries and new jobs is almost nil.
7) Environmental energy and safety standards have constricted individual initiative and preempted the use of resources from industrial product wealth generation. They have created a regulative climate that severely restricts entrepreneurial initiative based on good, sound, scientific and engineering research and development.
8) Industrial companies are unable to cooperate on fundamental generic application research for fear of possible anti-trust violation, causing duplication of effort and increased product cost.

Since World War II we have generated jobs for a phenomenal number of people (12,800,000) entering the labor market and have, until now, held our unemployment rate low. But this has been based on our absolute productivity lead that supported the primary industrial and secondary service market. However, by 1990, unless we act, this slim advantage will have disappeared. Other industries and employment opportunities will have joined steel, autos, shipping, textiles, photographic equipment, consumer electronics (radios, televisions, etc.), in their abdication to other countries. We will be further pressed by the rapidly increasing resources, education and initiative of the LDC's (Less Developed Countries), as head-to-head competitors for world position.

CORRECTIVE POLICIES

We must take immediate and constructive steps to alleviate, terminate and reverse the decline of U.S. productivity. We should, from a policy and planning standpoint:

1) Accept the fact that we have a serious productivity problem impacting our economic existence.
2) Set goals to:
    a) Reverse productivity decline by a practical yet attainable point in time.
    b) Stabilize our world economic position with constructive international policies and trade goals.
    c) Enhance the utilization of our physical and human resources.
3) Establish strong and aggressive policy initiatives to accomplish our national productivity goals.
4) Encourage R & D on technologies that will result in new products and processes and create new jobs.

We must acknowledge the fact that the "bottom line" of our productivity problem on its present course will be a disaster for the U.S. economic system and standard of living unless we accept the important of technology in regaining world leadership.

We must acknowledge the fact that the "bottom line" of our productivity problem on its present course will be a disaster for the U.S. economic system and standard of living unless we accept the importance of technology in regaining world leadership.

To understand the important role technology plays in increased productivity, we must look at the following figures covering the past 40 years. According to E. Denison of the Brookings Institute, these factors make up productivity:

Technology	*38.1%*
Capital	*25.4%*
Labor Quality	*14.3%*
Economies of Scale	*12.7%*
Resource Allocation	*9.5%*

Having highlighted the problem and its general causes, we must now turn to the plan for a solution. In our perception, the above are perhaps the most important figures in this paper. They indicate the points on which we should focus our resources for attack.

Innovative technology in products and processes has been the source of our economic well-being. The Japanese recognized this, copied our technology, applied engineering and management skills in a favorable climate, made heavy capital investment, and took world economic leadership away from the U.S.

To regain that leadership, we must develop innovative technologies and apply heavy doses of capital to create a new and expanded industrial base that will create the solid jobs necessary for our economic well-being.

We must promote quick and effective transfer of leading edge technologies into new products and manufacturing processes.

We must promote quick and effective transfer of leading edge technologies into new products and manufacturing processes by:

a) Encouraging industry and government to invest in applied and new technologies.

b) Setting depreciation schedules that are more compatible with the real world of obsolescence. Grant special tax credits for the added risk involved in accepting and installing new technologies.

c) Changing the patent laws to permit individual innovative entrepreneurs to retain adequate proceeds from their inventive efforts. Transferring dormant technologies from the public sector to useful job creating products and processes in the private sector.

d) Encouraging individual savings and investment.

e) Encouraging, by tax law changes, the formation of small enterprises based on new research and technology (fall off in rate of formation of small firms since tax law changes in 1969 and again in 1976 are almost total).

f) Encouraging development of meaningful interface mechanisms to permit timely in-flow of new foreign technologies to the U.S.

g) Accelerating the development of government policies, legislation, and regulation designed to encourage more effective use of our human resources, through training, education, and recognition of financial support needed for new and evolving skills and technical careers.

h) Streamlining the myriad components of the Government, Executive Branch, Congress, technical and scientific committees, etc., to work more efficiently to identify goals and promote policies leading to the rapid solution of our productivity problem. Terminate endless, time-consuming and self-serving cosmetic debate, and replace it with action and solution-oriented agreement.

i) Directing top management in acceptance of the role of new technologies and committing their enterprises to these applications and uses.

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March, 1981

Robotics Technology—A Major Component in the Solution of the U.S. Productivity Problem

Robot Insitute of America
One SME Drive
P.O. Box 930
Dearborn, Michigan 48128

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The United States has almost lost its productivity lead to its major internal and international competitor—Japan. Continuation of present productivity trends will, in 1990, irreparably damage the U.S. trade position and its standard of living. The U.S. must immediately emulate the Japanese by setting national policies and goals to encourage productivity. Specifically, it must accept, as do the Japanese, technology and robotics as the major tool to increase productivity. It must encourage a climate of cooperation, and change its tax structure to encourage both capital formation and the rapid installation of robotics in U.S. production operations. Its depreciation policies must reflect true obsolescence and deterioration of equipment and permit adequate capital recovery for replacement. Robotics and the innovative technologies should receive special additional tax credits to speed their installation. CONCLUSION—The United states is enjoined in a struggle with Japan for its economic life and standard of living.

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Robotics Technology— A Major Component in the Solution of the U.S. Productivity Problem

Executive Summary

The purpose of this paper is to show how robotic technology can be a major component in reversing the current declining trend of U.S. productivity. A comparison is drawn between how Japan accepts, uses and promotes the technology and what should be done in the U.S. by industry and government. It is not our opinion that we emulate the Japanese but rather learn from them, as they learned from us, and apply, intelligently, the ideas that make sense. It should be recognized that the U.S. is the leader in the development of robotic technology and Japan is the leader in applying and using the technology.

The following is what should be done by industry and government to implement an agressive program to infuse robotic technology in U.S. industry and surpass the Japanese:

INDUSTRY

1) Make the firm decision for large scale incorporation of robotics in the production processes.
2) Assign priority to robotic installation, recognizing it as a form of automation that is one of the quickest and least expensive ways of increasing productivity.
3) Provide supervisory and engineering training that will assist them in understanding the advantages of robots and how to use them and accept the responsibility for participating in the retraining and upgrading of the displaced workforce.

GOVERNMENT

1) Set national policies and goals that will permit rapid modernization of production facilities and the rapid installation of robots by establishing robotics as a major strategic industry.
2) Restructure depreciation schedules so they are more compatible with the real obsolescence of industrial equipment.
3) Immediately match or surpass foreign government incentive programs for robotic infusion.
4) Provide government funds to assist in generic applied research for advancing robotic developments.
5) Provide assistance for the retraining of displaced workers.
6) Change tax laws to encourage capital accumulation, recovery and investment in innovative processes and products.
7) Eliminate the adversary condition between government and industry and set a political climate to encourage cooperation toward national goals.
8) Understand that failure to adopt new technology and invest prodigious amounts of capital in new plants, equipment and processes is a direct roadmap to loss of jobs and plant closings.

Japan Uses Robotics as a Major Economic Weapon

The Robot Institute of America recently issued a background document on the subject of productivity and how it affects the United States' standard of living, inflation, employment, economic soundness, and loss of world export leadership. It covers the history of our productivity deterioration from factors that contributed to the current climate which, after six years of "problem defining and measuring" still leaves us without coherent national policies and goals. And in a broad sense, it lists the areas in which action must be taken. The Institute felt such a document was necessary if all groups in the United States were to have at least an elementary knowledge of the problems they face. Little is said in this document that has not already been said by hundreds of industrialists, economists, executives, government officials and others. Placing all their papers side by side would reveal a remarkable similarity on what the problem is, how it developed, and how to solve it. The consensus that is not revealed is the sorting through of and the will to act in a cohesive, cooperative spirit that would put behind us our last few divisive years.

The Japanese have not been noted for their innovativeness. Rather, they have been excellent emulators. They are basically superb, thorough, and exceedingly energetic engineers. In fact, they have researched and used excellent managerial talents, copying our technology and products, to become our foremost economic adversary. The Robot Institute feels, therefore, that we should look at the things Japan did to achieve superiority and use their successful tactics to regain our leadership. It is now apparent that Japan has passed to an innovative mode from strict emulation. Examination of their strategy and motives reveals that next to strategic planning and national goal setting, adequate and new technology are their major strengths. Within that framework, robotics has emerged as their major weapon.

The Robot Institute of America asks the question, "If Japan Can. . .Why Can't We?" Let's look at what Japan has done:

The Japanese have not been noted for their innovativeness. Rather, they have been excellent emulators.

Japan, like other countries, has inflation. But its causes are different and it has acted quickly and effectively to keep it under control; So far, the U.S. has failed to accomplish this.

The Chase Manhatten Bank Newsletter says, "Japan seems to be winning the battle against inflation." Consumer prices rose only 4.8% in 1979, 7.5% in 1980, and will project an increase of approximately 6.0% for 1981. These figures are parallel with both OPEC prices and OPEC events (war, hostages, etc.). And while most of Japan's consumer price increase has been due to oil, it has other domestic forces under control largely by massive increases in productivity, strategic cooperative planning, major doses of technology improvement, and capital investment.

> "We have prevented imported inflation from becoming domestic home-made inflation"—Isamu Miyazaki, Vice Minister, Japanese Economic Planning Agency.
>
> ". . .there currently is very little home-grown inflation here"—Eric Hayden, Tokyo based Vice President, Bank of America. . .99% of it (inflation) is from offshore."
>
> "Japan does not have the wage/price spiral of other countries," states Tsotomu Nishimura, Chief Economist, Sumitomo Bank. (The 1979 wage increase was 6.9%, 7.3% in 1980, and the 1981 forecast by Mr. Miyazaki, Japanese Economic Planning Agency, is 7.9%.)
>
> More importantly, productivity is keeping pace—6% in 1980, considered a good year, and a forecast of 11.0% for 1981. Therefore, unit costs of production have remained relatively stable, accounting partially for the Japanese cost advantage in foreign trade. (Most charges of Japanese dumping turn out to be simply lower costs because of greater productivity.)

Assistant Secretary of Labor under the Carter administration, Arnold Packer, said, "The difference is we have labor leaders who insist on wage increases that far outstrip productivity, and the Japanese don't." According to Yoshihiro Inayama, Chairman, Nippon Steel, "Cost of living increases are not used in Japan, so wages do not rise automatically with price. The countries with the worst inflation are those that link wage increases to price increases."

> "We have prevented imported inflation from becoming domestic home-made inflation—Isamu Miyazaki, Vice Minister, Japanese Economic Planning Agency.

Japan has also successfully restricted the growth of its money supply. In 1980, it was only 8.0%. Interestingly, Japan has horrendous national deficits ($67.9 billion in 1980) for a country half the population size of the U.S. The difference is that funds are borrowed from the Japanese people, who save 20% vs. 5% in the U.S., and Japan does not pay its deficits with printing press money. According to Mr. Hayden, Bank of America, in Japan, the people and the government save and in the U.S., the people and the government spend.

What specifically does Japan do to promote the use of technology in solving its inflation, productivity, and world trade problems? First, Japan sets national goals and objectives, combined with consensus and priority as an integral part of the setting, followed by strategic planning for their implementation. Second, Japan takes a specific technology such as robotics (of which the U.S. was the founder and leader) and makes it a prime inclusion in its industrial operations, improving its own productivity and enhancing its world market position for its products. Japan presently has over 7,500 installed robots.

Japan, as a part of its own international and multinational plan, intends to market robots internationally starting with low cost, lower technology robots and working up into the more sophisticated robots as they enter and secure markets. (In late 190, Fujitsu's new plant had a capacity to produce, yearly, more robots than are currently installed in the entire United States.)

Factors in the Japanese culture that promote robot acceptability are:

1. Guaranteed lifetime employment until age 55-60.
2. Payment of semiannual bonus from company, based on productivity and company profitability equal to 2-5 months of the worker's annual salary. Workers have not opposed robotics because its potential for increasing productivity and profitability enhances their bonus.
3. Assumption by Japanese companies of the responsibility for retraining and upgrading the skills of displaced employees.
4. MITI (Ministry of International Trade and Industry) has deliberately identified robot production as a major strategic industry, vital to Japan's national and international trade development. It regards the installation of robots as necessary to offset Japan's scarcity of labor, to reduce job labor content, and to enhance economies of scale in manufacturing.

   MITI has not just talked. It has taken specific actions to implement its robot strategic plan:

   a. With MITI direction, Japan Robot Lease was founded in April, 1980. It is jointly owned, 70% by the company members of the Japan Industrial Robot Association and 30% by ten, non-life insurance companies. The objectives of Japan Robot Lease are to encourage and support robot installation by small and medium size Japanese manufacturing companies, thereby increasing their productivity. Because 60% of operating capital is furnished by government subsidy (Japan Development Bank loans), the leasing conditions will be more advantageous than regular leasing.
   b. MITI has arranged for direct government low-interest loans to small and medium sized industry to encourage robot installation, to automate dangerous processes and to increase productivity. The Small Business Finance Corporation budgeted in February, 1980, 5.8 million yen ($19,000,000 U.S.).
   c. MITI has permitted manufacturers who install robots to depreciate 12.5% of initial purchase price in addition to regular normal depreciation.

> "The difference is we have labor leaders who insist on wage increases that far outstrip productivity, and the Japanese don't."

5. The Japanese Industrial Robot Association indicates robot production in 1979 was 36.0 billion yen ($180,000,000 U.S.) and projects 195.0 billion yen ($975,000,000 U.S.) in 1985.[2]
6. Although auto production dominates in the use of robots, robots are well diversified across the industrial spectrum, both in arc and spot welding, painting, materials handling, machine tools and assembly.

JAPAN'S PLANS FOR THE NEXT DECADE

Future Japanese strategic plans call for:

1. Rapid expansion into high volume operations. This will permit quantity production of standard robots that will take advantage of economies of scale both in manufacture and use.
2. Increasing focus on "intelligent" robots which represented 9.9% of sales in the first half of 1980.
3. Increasing focus on development of batch manufacturing technology to permit cheaper product diversification.
4. Targeted generic research in vision and tactile sensing for greater flexibility and expansion of the robot user market.
5. Declaration by MITI that robotics is the technology that will permit Japan to hold its productivity lead.

> Fujitsu's new plant had a capacity to produce, yearly, more robots than are currently installed in the entire United States.

WHAT SHOULD THE UNITED STATES DO?

Industry

1. Complete its feasibility studies and make the firm decision for large scale incorporation of robotics into its production processes.
2. Make large and long term commitment to the acceptance and inclusion of robotics. This will permit U.S. manufacturers to expand their manufacturing capability to supply the needs of U.S. industry and prevent the incursion of Japan into U.S. markets.
3. Accept the responsibility for retraining and upgrading its work force when displaced by or when augmenting robot usage.
4. Assign priority to the installation of robots, recognizing that robots are one of the quickest and cheapest ways to increase productivity.
5. Cooperate with worker groups to assist them in understanding the advantages of robots and accept them more easily. Assign priority of installation to dull, dirty, dangerous jobs. Work out plans to share the benefits of increased productivity. Emphasize that we must have the long term advantages of robot technology, but that they will not happen without near term dislocation of work force, some rather severe.

Government

1. Set national policies and goals that will permit rapid modernization of production facilities and the rapid installation of robots. Establish robotic production as a major strategic industry.
2. Structuring depreciation schedules that are more compatible with the real obsolescence of industrial equipment. Permit rapid write-off for more certain capital recovery.
3. Immediately match (or surpass) foreign government incentive programs for robot usage.

4. Encourage deployment by the Department of Commerce of some of the resources and authority of the Stevenson-Wydler Technology Innovation Act of 1980 to support generic research for tactile and visual sensing for advancing precision robotic developments suitable in a wide range of industrial processes.
5. Provide assistance for the retraining of displaced workers, including attention to our nation's public education system which reflects an appalling lack of basic math and science training required to upgrade unskilled workers for participation in more advanced industrial production processes.
6. Immediately change the tax laws to encourage capital accumulation, recovery, and investment in innovative processes and products.
7. Take immediate steps to eliminate the adversary condition between government and industry, and set a political climate to encourage cooperation toward national goals.
8. Understand that failure to adopt new technologies and invest large amounts of capital in new plants, equipment and processes is a direct roadmap to plant closings and loss of jobs. Technology (38%) and capital investment (25%) equate to over 63% of the driving force that creates new industries and jobs.

SOURCES

1. NBC, "If Japan Can, Why Can't We?" 24 June, 1980, Lloyd Dobbins, Narrator.
2. Aron, Paul. Report on Robotics in Japan. New York: Daiwa Securities America, Inc. (1980).

Mr. **Walgren**. Thank you very much.

The other two witnesses made direct, positive statements of the questions that I had on my mind.

Mr. Brown.

Mr. **Brown**. May I just thank both of you gentlemen for your excellent testimony and for your previous cooperation in assisting the development of some of the directions which are reflected in the Stevenson-Wydler Act.

I continue to feel that this is a useful policy tool and, as Senator Schmitt pointed out, it may not solve all the problems, but it represents a bona fide effort to move in the proper direction.

It's my hope that this administration, after it gets in place its economic program, which I trust will restore more of the cooperative relationship between government and business, will be willing to see the advantage of vigorously implementing this. And it would be our hope they would do that.

Now, Mr. Mericle, you made some reference in your statement to the need for more vigorously pursuing the trade advisory groups. And I am interested in whether or not these might be a vehicle for gradually building up an infrastructure of cooperation which would perhaps then lead to activation of the generic technology centers?

Now, we have, in agriculture, a very successful program of cooperators with agricultural sectors that want to export in large volume. Basically, they are aimed at developing market information and market planning. Essentially, I presume, this is what you propose for these groups. But I am thinking of a broader scope which, based upon their analysis of foreign markets, could then feed back into what is needed in American industry and help begin to develop ways of penetrating those markets if they do not exist today. It's not so necessary in wheat, for example.

Mr. **Mericle**. Right. I think they certainly can contribute in that way. And you are looking at the export end. There are, of course, great diversities between the companies, such as Mr. Danforth's and our own. We really don't need that kind of information. We know where the markets are and so forth.

On the other hand, the smaller companies do need that assistance, and they should have it, because they don't have the infrastructure within their own organization to do it.

Then you get into other areas—and I don't know whether this is appropriate at this point or not—by mentioning tax guarantees as an example.

But I'm not talking about financing loans or anything like that. I'm talking essentially about guarantees where we do go in, you know, that could be spread broad-based and the individual company doesn't have to take the risk. This is very important, and mainly because our competition in other countries have this; and it's a very simple thing, and it's extremely difficult to compete against.

So, those are the kinds of things, yes, that really could be of great value.

Mr. **Brown**. Mr. Chairman, in view of the time, I will defer to some additional questions. Or perhaps we could get some answers provided.

Mr. **Walgren**. Thank you, Mr. Brown.

Mr. Ertel.

Mr. Ertel. Thank you, Mr. Chairman.

I had made a note to ask you, Mr. Mericle, about these financial guarantees, because I was concerned about exactly what you meant by that. Are we subsidizing now? Is this an export-import bank?

Mr. Mericle. Well, maybe I can give you an example. In fact, I think I just read in a magazine on the way in here something to the effect that the Export-Import Bank, 60-some percent of the funds go to six companies.

Mr. Ertel. Five.

Mr. Mericle. All right. Thank you.

For a company like ours to deal with the Export-Import Bank on a average sale is very laborious, almost hopeless proposition.

On the other hand, let's go to a country where I can speak definitely. We have a plant in Austria, which I export 95 percent of my production. I can literally, by sending a messenger down to the government office, get approval of an order, and I'll pay one-half percent insurance fee on that. And I have a 90-percent guarantee against commercial risk and 100-percent guarantee against political risk. And it's the ease of doing it. I mean, the Export-Import Bank, to me, is of no value.

Mr. Ertel. How big is your company?

Mr. Mericle. We are close to $1 million.

Mr. Ertel. You're in the Fortune 500, I assume?

Mr. Mericle. Yes.

Mr. Ertel. Where in the structure?

Mr. Mericle. Oh, about midway.

Mr. Ertel. And you can't use the Export-Import Bank?

Mr. Mericle. No, because we are selling individual machines. We're not selling big plants or something like that.

Mr. Ertel. You're not selling 20 aircraft?

Mr. Mericle. No, no. You know, we sell machine tools, essentially machinery, robots, things like that. And, you know, we're talking of a price tag of maybe an average—a quarter of a million dollars. You just can't handle it through Eximbank.

Mr. Ertel. You think this administration would buy such a program as you're suggesting?

Mr. Mericle. I don't know. I can't answer that. I would hope they would, because as I say, I have experience working under these kind of programs, and they are very successful. They work very well. And exporting from here, I'm competing against them, and I am at a great disadvantage.

Mr. Ertel. It's my recollection we had a program similar to that. I'm trying to think of what it was.

The Overseas Private Investment Corporation. Didn't they insure all companies going abroad against political risks and guaranteeing payment?

Mr. Mericle. There was some of that, yes.

Mr. Ertel. Did you have any experience with that group?

Mr. Mericle. No, I did not.

Mr. Ertel. The other thing I was interested in was you wanted to expand this to make it industrywide research.

Mr. Mericle. Yes.

Mr. **Ertel**. It seems to me it would be an interesting thought—and I think it probably makes some sense because the broader your area, the more transfer you get within the technology.

Mr. **Mericle**. Well, I think in my statement I made there, really the distinction between high technology and I would call it a lower level—and I think Mr. Danforth, relating to his experience in Japan, which we have all experienced—a good example would be the robot. After all, robot is a magic word now, and we're one of the leaders in the world in building robots and have spent a tremendous amount of money developing these and their applications.

Now, that, to me, is the high tech, the visual, the form recognition, and all that.

What he's talking about and what the Japanese are doing is really the application of these robots into the manufacturing system. I mean, actually producing parts. You know, you've got the robot; that's one thing. But what do you do with it? How do you use it?

Mr. **Ertel**. Aren't you the one that builds the parts that go into the system?

Mr. **Mericle**. Yes; we do.

Mr. **Ertel**. And then why should we have to do that?

Mr. **Mericle**. There's a limit to how much you can do there. It takes a broader base than that, because we don't do the whole thing.

In other words, if automotive came to us and said, you know, do this great factory to build engines, we would have to go beyond our own company to do that. We couldn't do it. We don't have all of that within our own company.

Mr. **Ertel**. My impression was what he was referring to in Japan is they wouldn't build a factory either; they would try and design individual machines which might be parts of that factory. And isn't that what really you're doing already? Aren't you our robot center?

Mr. **Mericle**. Well, it's interesting—and I'm sorry Mr. Danforth is gone—because as a result of his many visits there, why Westinghouse is very deep into the design and building of the so-called focus factory or feeder factory, which you're probably familiar with and which we are cooperating with. I mean, again, it's Westinghouse, it's Milacron, and it's about—we're doing it on our own. I mean, it's a big project, but we couldn't do it by ourselves. I mean, we don't have the wherewithal within the company to do it. We're certainly contributing to this one, and hopefully it's going to be the first one in this country doing it.

Mr. **Ertel**. What amazes me though is I am hearing today something different from public statements that I have heard. Maybe it's not Milacron, but certainly Westinghouse—the great free enterprise system is going to solve all the problems of the world, just unleash the free enterprise system.

And today I have heard from all three of you that we need a government program to set up an institute to do this.

Now, how do you square those statements, if you can? I don't think you can.

Mr. **Mericle**. You want to answer?

Mr. SALLOT. They're not mutually exclusive. Actually, they overlap. When you talk about the free enterprise system, it just says let us be free to do what we would like to do. But you can't do that without some help.

Now, I don't think any of us today have advocated an overall government planning system. I think we have all been talking about a catalyst.

Mr. ERTEL. Are you suggesting Mr. Danforth advocated a government plan?

Mr. SALLOT. I don't think he did, in an absolute fashion; no, sir, because I know Mr. Danforth and I know the people at Westinghouse very well. In fact, many years ago, the forerunner of their present Robotics Institute was a project within Westinghouse that I think was partially funded by a grant from the National Science Foundation that looked into the problems of the system of assembly, using not only robots but machine tools and other assembly machines.

I think if you understood him to say that, that possibly wasn't what he meant.

But my point was going to be that we live in a climate today that is totally different. You no longer go out and buy a machine and put it in a corner of the plant and produce with it. That machine is only a part of a major system. We are in the era of the systems approach to everything, a systems approach that ultimately will lead us—we probably will never attain it—ultimately to the concept of the automatic factory. You have supply modules, you have machinery modules, you have assembly modules.

Throughout it, you have the tool of the computer control, you have the language interface problems, you have all the people problems, the supply problems.

You have to solve the problem, as Mr. Danforth pointed out, of beating the Japanese KAN/BAN system, where their inventory, depending on what product you're looking at, turns over 70 times and ours is lucky to turn over 3 times. You have to beat those things. And the only way you can do it is by the systems approach.

Now, no one company or no one industry is going out and solve the interface problems of working two systems concepts with another company or with another industry. That is an area in there that—while I think the Center for Automation of the Bureau of Standards is just starting to address now—it will take many years before it really becomes an effective force in that area.

But these gray areas between are what you have to address and solve on a generic basis and make available to all. After all, that's the way the Swedes and the West Germans and the Japanese presently do it. Their unmanned factories over there were all modules, and those modules are capable of being put together in many different fashions to make many different products. And that's what we call the systems concept.

And only some force outside the labor and the industry can catalyze an action of that nature. And that's what we're saying that the U.S. Government should do.

After all, we face that in our competition every day. Let's be realistic. If our competitors are doing that, then what is so dirty about us doing it? After all, in the last few years, we have come from the fact that profit is no longer a dirty word. Why can't we come from the fact that being totally free in the environment out there to do as you darned well please has been modified to where we must do some sort of voluntary and cooperative planning to achieve goals.

I think you will find Westinghouse, General Motors, General Electric, and all of these companies talk about strategic planning, and some of them go out 20 years. I don't see what's wrong with cooperative strategic planning in the area of setting national goals and bringing our forces together to meet them. I don't see what's wrong with that.

Mr. ERTEL. Maybe you are speaking to the wrong person. I suspect that speech should have been given to the Business Round Table, the national chamber of commerce, and the NAM. I'm not so sure in Congress, because we don't see that kind of role.

But I think you're getting a resistance to that role of Government, and I see it in this administration, to be frank, without being partisan. This administration doesn't see the Government doing that. This administration sees the Government just withdrawing completely, as I look at it, and allowing people to go out there and compete on their own basis and solve the problems. Witness the synfuels industry—complete withdrawal, or at least alleged withdrawal by the Government.

Now, how do you square that with the rhetoric we have been hearing in the public from maybe Cincinnati and I know Westinghouse?

Mr. SALLOT. I'm not sure it's my job to square that. I think it's only my job, as a representative of an organization that exists for the public good, to state what we think should be done based on our experience and our professional knowledge.

Mr. ERTEL. Again, I would ask Mr. Mericle whether he agrees?

Mr. MERICLE. Maybe it's our interpretation of the Government role, not saying they should be the great planner and all that, but I did make a number of suggestions in here as far as tax credits, for example, antitrust policy, and things like that. Those are the things that would unleash a lot of effort on the part of industry that we can't do right now.

In other words, I cannot join with my competitors to do some of this development work that I'd like to do.

So these are areas that I think—and, of course, this all then, as I mentioned, in the end is a development of the people. And I'll give you an example.

For example, at the schools and universities right now, you can imagine over the years how many machines and robots and so forth we have contributed to these colleges, because they never have enough money.

Years ago, that was very simple, because you gave them a lathe, a milling machine, the drill press, and it was good for 20 years.

With the speed at which technology is moving today in the area of controls and robots and so forth, particularly in the electronics end, obsolescence sets in almost the day you ship it. We no longer can afford to do this. We just can't deprovide a quarter of a million machines to dozens of universities that are going to be obsolete in 2 years. And so, as a result, we don't have the facilities there to even train the people. This is another area which is a very serious problem in our educational system, of providing this.

Mr. **Ertel**. I don't want to belabor this, but I might just point out that this administration has zeroed out science education. And I assume you agree with that position after your last statement.

I have no further questions.

I know you don't.

[Laughter.]

Mr. **Sallot**. May I make one last comment?

Mr. **Walgren**. Certainly.

Mr. **Sallot**. We have been involved in these matters many years, as I laboriously pointed out. But we have a public organization—or a nonprofit organization, and, as such, devote and dedicate a certain percentage of our resources to the advancement of the public good.

We have been invited, all along the way, to participate in these activities. We would consider it improper, as an organization, to take sides on an administration against another one or to become involved in any kind of a political cat fight.

Our only purpose in life is to take the combined expertise and knowledge of our members and present it for the public good and hope to shape those programs of public policy that will benefit all of us.

Mr. **Ertel**. If I may respond to that, no one is asking you to take a dog and cat fight. But if you really believe you want to shape public policy, then you are going to have to take a position. You're going to have to take a position either against or for certain policies.

And if you think the policy is wrong that's being enunciated, then you ought to speak out. The only way you influence that is by speaking out as to that policy. It doesn't matter whether it's in the political forum or not.

Mr. **Sallot**. Congressman, attached to my statement are two position papers moved by our board of directors that supported the programs that I supported today. These were not done in a vacuum. We have taken positions on those. What we would now like to see is some reaction to them.

Mr. **Ertel**. Right, a reaction in Congress and in the administration. I hope you're right.

Mr. **Sallot**. The executive branch, the regulatory, and industry; yes.

Mr. **Walgren**. Well, I'd like to say I'm particularly pleased with the testimony of the industry panel. And I thought you were all certainly forthright in what you supported.

In particular, I was struck by the fact you were able to include in your testimony that—and I quote: "Having conceived together a largely agreeable institutional approach to the problem, it was the Government that abruptly terminated the relationship by not funding the program."

I take it, from this hearing, without being partisan about it, the administration policies in this area are not directly approved by the industry witnesses which we have heard today. I'm sure there's a difference of viewpoint on that, but that fact should not go unnoticed in the administration.

And perhaps they will come around to understanding the validity or the drawbacks of an absolute approach based on philosophy and spirit. This is an area that is much to gray for that. That's my own personal opinion. And I think, hopefully, that your testimony will lead them in that direction.

Mr. **Sallot**. Congressman, it is no black and white solution. It's all gray, which is what you just said. And I think you need a meeting of all of the positions. You haven't heard from academia here today, although you are going to hear from them later on. But they play a very significant role. They have to become part of our family, just as everybody else does.

Mr. **Walgren**. OK. With that, we will end this morning's session.

We are putting over, until tomorrow, the testimony of Jordan Baruch, who was to be our last witness today.

And I want to express my personal appreciation for his flexibility in going over until tomorrow.

We have found this last panel to be very, very instructive, and we appreciate it.

[Whereupon, at 12:40 p.m., the hearing was adjourned, to reconvene at 9 a.m., Wednesday, July 15, 1981.]

IMPLEMENTATION OF PUBLIC LAW 96-480, THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

WEDNESDAY, JULY 15, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met at 9 a.m. in room 2325 of the Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Present: Representatives Walgren, Brown, Shamansky, Ertel, Heckler, Weber, and Skeen.

Also present: Representative Wes Watkins.

Staff present: Thomas R. Kramer and Donald Rheem.

Mr. **Ertel**. The subcommittee will come to order.

Today we start a second day of hearings on the Stevenson-Wydler Technology Innovation Act and the implementation of it, which obviously this administration has chosen not to implement.

We had witnesses yesterday. Today we have the honor to have with us Senator Mathias. He will be our first witness. We appreciate you coming over and joining your colleagues on this side of the Capitol.

TESTIMONY OF HON. CHARLES McC. MATHIAS, JR., U.S. SENATOR FROM THE STATE OF MARYLAND

Senator **Mathias**. Thank you very much, Mr. Chairman. I am delighted always to come back to the House. I'm mindful of that ancient wisdom that when a Member of the House moves to the Senate it elevates the intellectual level of both bodies. [Laughter.]

Mr. **Ertel**. In this case there was an exception made when you moved over there.

Senator **Mathias**. I have a brief statement which I would ask the committee's permission to submit and just comment very briefly.

Mr. **Ertel**. Without objection, we will be happy to have your extemporaneous comments.

[The prepared remarks by Senator McC. Mathias follows:]

REMARKS BY

SENATOR CHARLES McC. MATHIAS, JR.

Mr. Chairman: I appreciate the opportunity to testify before the Subcommittee on the Stevenson/Wydler Technology Innovation Act of 1980. I strongly support the general concept of the law, which is to ensure the fullest possible return on our Federal R & D investment. Today, I would like to focus my attention on Section 11 of the Act entitled the "Utilization of Federal Technology."

Our nation has achieved greatness in a large measure because of our scientific and technological genius. In many ways, this is our greatest resource. In this area, we still have a significant lead over the rest of the world.

In addition to sophisticated equipment, it has brought us a tremendous storehouse of knowledge -- a virtual warehouse of scientific and technological expertise. But, the problem is that not enough people have access to the warehouse; we are not using the resource to the fullest. Of special interest to me as Chairman of the Senate Governmental Affair's Subcommittee on Government Efficiency is the fact that we are not using this resource to solve the toughest problems this country faces -- the problems of state and local government. Many of these problems are technical in nature and should be addressed by our best scientists and engineers. Yet, a shockingly small percent of the $40 billion in R & D expenditures is aimed at these problems. That is why Section 11 of this Act is so important. It requires that every federal laboratory establish a technology transfer office and devote a portion of its efforts and its resources to helping state and local governments and the private sector. In addition, the larger laboratories are required to assign at least one full-time professional to that task. Each federal agency with one or more R & D laboratory is required to reserve one-half of one percent of its annual budget to provide the necessary financing for this effort.

I have been interested in technology transfer for a long time now simply because it is one way to get the maximum impact from our tax dollars. Last year, I sponsored a technology exchange conference where local and state officials were exposed to technology and technological advances by the federal government which could be applied to solving problems faced by them. Just last month I cosponsored another conference in Baltimore to expose members of the business community to federal R & D efforts that might help them in the vital role they will play in the national effort to revitalize the economy.

Last year, as many of you know, I introduced legislation similar to Section 11 because I thought it was imperative to encourage all levels of government and the private sector to get more involved in technology transfer. But, now that the Reagan Administration has called upon the local and state governments and the private sector to take up the slack created by the cutbacks in federal programs, technology transfer has become even more critical. Without greater productivity in these segments of society, our economy won't be able to bounce back very far or very fast. Technology transfer can provide a powerful assist in surmounting this challenge.

From the response to the two conferences we held in Baltimore, it is clear that both the business community and the local government sector are ready and eager to tap into this under-utilized resource. As everyone knows, cities have been active in technology transfer for quite a while now. Back in 1974, the City of Baltimore joined forces with NASA's Goddard Space Flight Center in a pioneering technology exchange experiment called the Baltimore Applications project. The project is still going and both Baltimore and NASA are pleased with the results.

We also have seen encouraging signs from a number of Federal laboratories.

But, at the same time, I am concerned by the apparent lack of general commitment on the part of the federal agencies. A strong policy directive from the federal agencies to their laboratories is essential for success. Once this is done, I am confident in coming years we will see tangible evidence of what can be accomplished through technology transfer.

Senate oversight hearings on this very issue are planned for this fall to examine in more detail the ramifications of this law in both the public and private sector. This week's hearings will provide a useful framework for those deliberations. We are all committed to finding better ways to run our government at all levels. This law and in particular Section 11 is an important step in that direction. It will not solve all the problems, but it will provide officials and the private sector with a valuable resource that can vastly improve their prospects for solving many of the problems that confront them.

Senator **MATHIAS**. Mr. Chairman, I think one of the most important products of America is our scientific and technological success. In many ways science and technology is the product that we can offer in the markets of the world. We still have, I think, a very creditable record in that area. I am hopeful that we can keep the lead that we have in the world. I hope we can make the kind of national commitment to maintaining our effort in the field of research, in basic research as well as applied science.

But in this area of American science and technology we are a little bit in the case of the shoemaker's children. We have this great reservoir of knowledge and technical ability which all the world wants to buy. People come to the United States and want our technology in one way or another. But we very often don't make it available to our own people in a convincing and in a convenient and in an economical way. And that really is what I think we need to concentrate on in the months just ahead. And that I think is what the Stevenson-Wydler Technology Innovation Act will promote.

Incidentally, I had introduced last year a bill which accomplished or which looked to very much the same accomplishments. We have a warehouse of scientific and technological expertise but not enough people have access to that warehouse either in local government or in the business community. And we have to somehow or other distribute keys to the warehouse and encourage people to get in and to use the information which has been accumulated both in the public and the private sectors through R. & D., through scientific study. And that very simply is what we need to do.

Now, I think that would be a good thing to do under any circumstances in any period of history. But at the moment I think it is absolutely critical, because we are in a period of deemphasizing Federal programs; we are in a period of reemphasizing the activities of the private sector. And if the private sector is to be able to shoulder in an efficient and productive way the kind of burden which is being thrust upon them, whether they want it or not—and I think sometimes they say they want it but are a little reclutant to pick it up—they are going to have to have access to this warehouse of knowledge, this warehouse of technological expertise.

Thus, I would hope that we would, by using the Technology Innovation Act of 1980, make the keys to the warehouse more available.

That, Mr. Chairman, very briefly, is my message.

Mr. ERTEL. Thank you very much, Senator. We appreciate your comments. Then I take it you are in favor of trying to implement the Stevenson-Wydler Act and to fund the implementation of it?

Senator MATHIAS. I would be, indeed. And I think as keen as we are on balancing the budget, and I'm keen on it, too, I think there are great advantages to doing that, but I don't think that you can balance the budget and increase productivity and provide for the long-range economic welfare of this country without spending some money somewhere along the line. You have to spend money to make money.

This is one of those cases where I think the investment will be returned many, many times to the American people.

Mr. ERTEL. Senator, you sponsored recently, I believe, in Baltimore, a conference on technological transfer from the Federal laboratory system. Senator Schmitt alluded to that yesterday. He said he is going to a similar thing in New Mexico. Can you give us a quick idea of how that worked and what you thought the advantages were?

Senator MATHIAS. Actually, Mr. Chairman, we've had two such conferences. One last year in which we got representatives from various Government agencies who conduct R. & D. of various kinds to come together in Baltimore to meet with municipal and county officials from the entire Middle Atlantic Region. These Federal officials exhibit and demonstrated the kind of expertise that had been developed in Federal laboratories or under Federal research contract that could be applied directly to the problems of local government, problems of great variety.

Maintenance of capital structures, for example, is one of the really critical problems for local government today, and what expertise has the Federal Government developed that might be applicable to that particular problem. A whole range. I believe there were almost 500 participants in that conference, and this year, just about a month ago we got again the representatives of the Federal R. & D. community, the agencies that either conduct in-house research or have research under contract, and brought them together with the private sector, with the business community.

What Federal R. & D. can you lift directly for the use of the business community? Just to give you an example, in Vietnam there was, of course, a terrible problem of body wounds. Because of the heat you couldn't use the existing body armor. And so the Army developed a very lightweight body armor that was relatively effective, and that expertise lay dormant for a long time. Now some clothing manufacturers, uniform manufacturers, have taken that technology and have been able to make body armor which is available for policemen and firemen in this country. It's a multimillion dollar business which uses a federally developed technology for the benefit of business, and ultimately, of course, for the benefit of the communities whose firemen and policemen are protected by this body armor.

And I could give you a whole string of that kind of example where some fairly exotic technology developed for a particular purpose by the Federal Government can be applied to ordinary, everyday uses in ways that create jobs, that make business and that perform a useful service in American society.

But unless you get that out of the warehouse and get it on to the street, it is going to be technology which is really useless.

Mr. **Ertel**. You have the Mathias Technology Transfer Act incorporated and developed by you for the State of Maryland.

Senator **Mathias**. Well, Mr. Chairman, you're very generous, charitable, this morning.

Mr. **Ertel**. Thank you very much, Senator.

Mr. Brown?

Mr. **Brown**. We appreciate your being here this morning, Senator, particularly in light of your own contributions tc helping create this process of utilizing the fruits of Federal investment for research and development.

We had yesterday the Under Secretary of Commerce and other representatives of the Department who generally indicated, shall we say, a restrained enthusiasm for the implementation of this law. But there were one or two areas that were pointed to as being implemented. Section 11, having to do with technology transfer, they indicated this kind of activity would continue. In section 5 they pointed to us something that fell well within the historical functions of the Department. It's an information gathering function, in large part. And I've been reading it over again. It basically says that the Secretary shall establish an Office of Industrial Technology and then the director of that office shall do a list of things. Basically, to understand better the impacts of technology on American society and to develop ways of improving that.

The Secretary also has somewhat reorganized the overall staffing of the Department, eliminating assistant secretaries here and creating them there.

Senator **Mathias**. That's a quadrennial exercise.

Mr. **Brown**. I was going to ask you this. Do we not have a phenomenon here which basically is an attempt to put the new administration's own staff on a series of activities or a scope of activities which they consider to be significant but they don't want necessarily just to pass on what they've inherited from the past administration? Do you see this as being a part of the phenomena taking place here?

Senator **Mathias**. Well, it's a recurring phenomena. It's not unique. It happens in each administration. I notice very often how the same old programs are given a new title, then things go on pretty much as before.

Mr. **Brown**. The Under Secretary, who has an excellent background in the larger problems of administration and in the statistical information processes related to that, made some emphasis on this, and I sought to determine if we couldn't build from this a fairly substantial effort to improve the role of the Commerce Department in the managing of science, scientific and technological information, on a broad basis, because frankly this is one of the defects in our overall handling of this at the present time.

Senator **Mathias**. Well, I think that you have put your finger really on both the opportunity and on the problem. The opportunity is there. There's not millions but billions of dollars worth of scientific knowledge and expertise that belong to the people of the United States. It ought to be used for their benefit either in the public or private sector. But until there is an aggressive effort to move that, the full potential isn't going to be enjoyed. And I don't question the good faith of the Secretary who comes up and testifies as to his intentions. I'm sure those are his intentions. But I think unless the Congress keeps a fire lit under this program it isn't going to happen. There are so many other things that crowd in every day, pieces of paper that have to be shuffled, letters that need signatures. The days aren't long enough to do them. And unless through our efforts here in the Congress we raise the priority of this project, I believe that we are not going get the benefit that we ought to get for the money that's already been spent.

Now I think we have one natural advantage here, and that is the fact that the Reagan Administration has put this focus on the private sector and on local governments. So that this is a natural. But again, I think it has to be marketed. I think we really have to push it in the marketplace and I don't believe that anybody else will do it if the Congress doesn't. That's my bottom line.

Mr. **Brown**. I won't belabor it, Senator. I know that you will continue your own efforts to focus on this area. And I think this Committee would like to give you some help in that and I hope we can continue to work together.

Senator **Mathias**. I appreciate that encouragement.

Mr. **Brown**. I have no further questions.

Mr. **Ertel**. Thank you, Mr. Brown.

Mr. Walgren.

Mr. **Walgren**. No questions, Mr. Chairman.

Mr. **Ertel**. Mr. Skeen.

Mr. **Skeen**. No questions.

Mr. **Ertel**. Thank you very much, Senator. We appreciate your testimony.

Senator **Mathias**. I'm very grateful to the committee for holding these hearings and for letting me come in and say a word. Thank you.

Mr. **Ertel**. Thank you very much.

The next witness is Dr. Jordan Baruch, former Assistant Secretary of Commerce for Science and Technology, who has appeared before this subcommittee on many occasions before. We certainly welcome him.

He also has an unusual distinction of being a former professor at Dartmouth at the Tuck School, which certainly gives him great credentials for being here since two of us on the subcommittee are Dartmouth graduates. You have a receptive audience.

Dr. Baruch.

TESTIMONY OF JORDAN BARUCH, FORMER ASSISTANT SECRETARY OF COMMERCE

Dr. **Baruch.** Thank you, Mr. Chairman, members of the subcommittee. I'm delighted to be here today, particularly as a representative of the private sector. [Laughter.]

I'm currently a consultant to a range of American firms and developing countries. My work entails helping them formulate their strategic and technological development plans.

Mr. Chairman, I have no prepared text, partly because I didn't have to get one cleared this time. [Laughter.]

Besides which I've testified often enough in favor of the Stevenson-Wydler Act that my views are well known.

I thought today that I could best serve this subcommittee by responding to the testimony that we heard yesterday.

The administration, in its omnibus budget-cutting efforts, has requested rescission of 1981 funds and 1982 zeroing of funds for two critical parts of the Stevenson-Wydler Act: The COGENT centers and CUFT.

Congress has acceded to this request, but without the opportunity for the level of deliberation that this subcommittee gave to the subject in planning and framing the act.

Gentlemen, I believe it is imperative that that decision be reversed, and I'm going to try to make clear why, and I hope I can convince you, and you in turn can convince the Congress.

It's my belief that if it's properly understood in Congress that that decision can be reversed while still staying within the cap set by both the administration and the Congress on the budget funds.

Mr. Chairman, there's little doubt that some of the administration's policies and steps will increase industry's willingness to invest in new technology—tax measures, tax credits, a wide range of things. Reduction of government regulations. There is great doubt, however, that those steps or any others already taken will increase industry's ability to invest in new technology. Sound investment requires the conjunction of both willingness and ability.

The COGENT centers visualized in the Stevenson-Wydler Act are aimed exactly at that problem: using public funds to create new basic technologies that entire industries can use to improve their products and processes.

These basic technologies, or generic technologies as they are called, because they are used by many firms, are not going to be developed by individual firms working alone.

Gentlemen, a basic reason for the administration's opposition to the COGENT program is its mistaken view that COGENT is a grants program. It isn't. It is no more a grants program than is the purchase of new weapons for defense. Both programs wisely spend public moneys to purchase public benefits, benefits that accrue to the public as a whole, benefits that would not be created without that expenditure.

Gentlemen, it is as fallacious to expect private industry to invest in creating our defense weapons because they feel threatened by the Soviet Union as it is to expect them to invest in creating basic technologies because they feel threatened by Japan. In both cases the preponderance of the benefits accrue not to industry alone, but to the public in general. It is appropriate for the public to purchase those benefits.

Mansfield, for example, noted economist, has shown that on the average new technologies and the innovations that grow out of them produce benefits to the public in general that are two and a half times as great, two and a half times as great, as the benefits that accrue to the individual investors.

Senator Schmitt yesterday talked about dynamic planning of our finances, and it's imperative that we recognize that the returns even to the Federal Treasury exceed by far the amount spent by the private investors on new innovations.

Gentlemen, the statement that it is appropriate for the public to purchase these benefits is not a matter of ideology; it's not a matter of political philosophy or posture; it is a simple statement of how, what the economist calls an externality, works.

Mr. Chairman, with the aid of the National Industrial Technology Board called for in Stevenson-Wydler we can start the COGENT program now. We can start building what we are missing and insure that the administration's program to encourage and increase industry's willingness to invest will be matched by an increase in their ability to exercise that willingness effectively.

Mr. Chairman and members of the subcommittee, we have a fine piece of legislation enacted. Expenditures called for under it and eliminated for 1981 and 1982 provide a missing leg for the administration's as yet incomplete strategy to stimulate this country's progress in industrial technology. They're expenditures which, even seen as insurance premiums, to back up Secretary Wright's faith, are trivial when compared to the potential public benefits.

Mr. Chairman, let me also comment, since I mentioned Secretary Wright, on the Department of Commerce's push for yet more analysis.

I saw a war movie on TV recently. I was looking for an analogy for yet more analysis. It showed a typical scene which you are all familiar with of a ship gradually filling with water and sinking by the stern. I suddenly realized that the captain must have added a couple of analysts to the crew. [Laughter.]

Clearly, one analyst saw the stern going down, but the one up in the bow saw the bow going up. The analyst in the stern called for pumps, but the one in the bow, seeing his part of the ship rising, argued that the ship would takeoff and fly if the water was pumped out. [Laughter.]

The Captain, I'm afraid, suffered from what we're threatened with and what we call at the Tuck School analysis paralysis. He did nothing, and the ship, of course, sank.

I hesitate to be humorous about such a serious matter. But we've got a ship that is filling up with foreign products. Although we see parts of it, like the computer industry, rising, we ought to be aware that we better start pumping, patching the holes, and filling that ship with our own technology.

Mr. Chairman, that captain didn't need more analysis; he needed action, action to patch the leaks and pump out the flood; he needed what we need—action. Action of the kind visualized in both the COGENT and CUFT programs.

Last, Mr. Chairman, I'd like to endorse Mr. Watkins', Senator Schmitt's, and Senator Wydler's efforts to enhance our technological transfer activities. CUFT, the Center for the Utilization of Federal Technology, set up in the Stevenson-Wydler Act, is a critical element. Our internal efforts in the R. & D. agencies and the people in them, people set up by the act as transfer agents, tend naturally to focus on those industries with which they are familiar.

We heard Senator Schmitt related yesterday how NASA found it easy to transfer its technology to the aerospace industry but that it was much more difficult and required a separately funded program to get that transfer to the medical community where it was so desperately needed.

We have another comment in Tuck that when all you have is a hammer everything looks like a nail. And as a result, when you have an agency that has a specific mission and specific body of contractors, everything is viewed in terms of its applicability to that segment of our private sector.

The laboratory consortium program under the National Science Foundation has formed—performed, rather, an important consolidating role in transferring technologies from those laboratories to the public sector State and local governments. We need the equivalent at the private sector where CUFT was envisioned at.

The transfer of technology is not publishing announcements in a book or publishing notes in NTIS, despite the great regard I have for NTIS; it is not simply a matter of having shows; those all help. What people need to insure the transfer of technology is adaptation assistance. They need the capability to get people to assist them in adapting that technology to their specific industry needs. CUFT was envisioned as providing that adaptation technology through the people in the Federal laboratories.

Mr. Chairman, members of the subcommittee, I realize that this is not an appropriations committee, and yet if I could, I would urge that the rescission for 1981 be revoked, although I recognize that that is essentially impossible. But I do urge on you that somehow $30 million be made available in 1982 to implement the COGENT and CUFT portions of the Stevenson-Wydler Act. Without them the act is an important but virtually helpless piece of work. With them it can become a major force in restoring our economic vitality through our technological advance.

Gentlemen, that ends my unprepared comments, and I would be happy to respond to questions from the subcommittee.

Mr. Ertel. Thank you very much, Dr. Baruch. I appreciate your statement and the fact that you didn't have to have it cleared by the OMB this time.

Mr. Brown?

Mr. Brown. May I just say, Dr. Baruch, I'm very pleased to have you back before the subcommittee to take advantage of your great knowledge and apparently occasional wit.

Mr. Ertel. Pardon me, did you notice that he is more witty now that he's not in the administration than he was before? [Laughter.]

Dr. Baruch. It's lovely representing only yourself and the public at large.

Mr. Brown. I have become convinced, Dr. Baruch, that the administration really is cognizant of the serious condition of American industry and would like to do something about it. I'm a little concerned that they feel, as the past administration felt, that their particular political solution has all the answers to it. I wonder if that course has to run, and they have to have their program in place for a couple of years to see that it hasn't solved all the problems before they will be willing to accept a program which is fairly consistent with their own aims and not inconsistent with their political philosophy. It's a cooperative approach on the part of the American industrial and governmental communities to solve mutual problems and I see nothing inconsistent in that with the President's philosophy. Much as I would like to force them to fund the COGENT and CUFT programs this year, I'm not optimistic that we can do it.

Perhaps you have some better clue, based on your own lengthy experience with the Congress and Government as to how we could do that than I do.

We sought to maintain those programs over which this committee has jurisdiction at a higher level than the administration wanted and we still haven't won that battle. We still have to fight that out in the National Science Foundation, authorization legislation which will have to come to the floor some time in the near future. And given the mood of the Congress I'm not at all sure we can maintain a higher level than the President's budget or restore these particular items that may be included in that particular authorization.

Dr. BARUCH. Mr. Chairman, I have no claim to political wisdom, certainly not after spending only 4 years in this milieu. But it seems to me that the minority members of this subcommittee, having been exposed to the hearings, understanding the feelings of the industry people themselves, understanding that the level of funding we're talking about represents in proportion to the expenditure that the administration is making to stimulate industrial activity through its tax measures and so on bears about the same proportion to that as the fire insurance policy that somebody would take out even if he built a fireproof plant. That wisdom would dictate that the Republican members of this subcommittee argue strongly with the administration and urge them to find the funds to support what I believe and industry believes can have a major impact on how the funds that are being freed up by the administration's policies can be spent most effectively. And if we cannot get that kind of help from them, the minority members of the subcommittee, I don't really know whether anything can be done.

I know Mr. Brown and Mr. Walgren, you are both very persuasive, far more persuasive than I am witty. My guess is that you have an important role to play with the members of the Appropriations Committee. I'm sorry that Mr. Watkins is not here today.

Senator Schmitt pointed out yesterday that within the cap set by the administration and the Congress there is room, if we recognize that certain steps can have a major impact on what the administration itself and the Congress itself is trying to accomplish. And my only urging is that this part of Stevenson-Wydler be moved up, and be moved up in recognition that it is not a simple grants program that violates the philosophy of the administration.

It is a program working with industry. I agree with the witness that was here yesterday who said that industry ought to support half the costs, and the Federal funds ought to disappear within 5 years, to insure that we have market forces behind those new technologies that are developed. But they are not going to be there if we don't work on them. And we are talking about numbers that are order of magnitude, at least an order of magnitude, a factor of 10 below what we know the Japanese Government is spending. What breaks my heart is, they are numbers of the order of magnitude which I expect the country of Greece to be spending in 1982 on this same subject. And I'm consulting with them on helping them develop this kind of strategy.

It is inappropriate for the United States not to recognize that it must establish a beachhead in the area of creation of new technology that inures to the benefits of a wide range of industry and to the public at large.

Mr. BROWN. Well, again let me express my appreciation to you for your contribution to this entire program as well as your testimony this morning, and I won't take any further time, Mr. Chairman.

Mr. ERTEL. Thank you, Mr. Brown.

Mr. Walgren?

Mr. WALGREN. Sometimes it seems we might be being political, but I was interested in your plea to the Republican members of the committee and the Congress to use their influence. I think that's particularly well addressed and well directed. It seems to me that there is a misimpression being given by the press that it is the bipartisan element in the Congress, particularly with the Democrats who voted with the Reagan administration, that are delivering this program; therefore it must have some broader validity. But the truth of it is that the unique factor in Congress, and it has been so in this committee, is the unanimity of the Republican Party in their approach to the budget votes thus far. In that sense it really is somehow their responsibility when they see a contribution that can be made in an area like this to try to rise above the urge to be unanimous.

Perhaps it doesn't have any place in this record, but it should be noted, I think, that less Democrats voted for the Reagan budget than voted against the Carter budget 1 year ago. And yet, to read the press, you would think that there was some kind of stampede in bipartisan recognition of the validity of this program. But the enabling factor has been the unanimity of the Republican Party coming out of the political momentum of the election. And somehow or other if there was a program of real value we should implore them to try to support that.

Dr. BARUCH. Mr. Walgren, I have a great deal of faith in the Members of the Congress on both sides of the aisle. I've enjoyed working with Mr. Ertel, though we haven't always agreed on patent policy, for example; a great deal of faith in their commitment to the advancement of American industrial technology. I don't think that's a problem. I think the mandate that was given to this administration was one that dealt with the totality of the budget. Now we're talking about a very minor quantity of funds within that totality that we're suggesting be shifted for two reasons—three reasons:

One, as an insurance policy in case the administration's program doesn't have all the answers. It's an ideal time for the administration to bolster its own policy and practice in stimulating industrial innovation.

Second, it's a chance to increase the American pie. We keep getting involved in our congressional discussions about how the pie will be split. Here is the most bipartisan of all possible questions: How can we increase the total pie? How can we increase our exports? Why is it that we don't have a single video tape recorder manufactured by U.S. manufacturers any more? How can we recapture what we are so rapidly losing?

Let me tell you something that frightened me. I have long looked at the Japanese computer industry and said, well, they're very good at hardware but when they get to the software end they're going to have troubles. And I have an Apple computer, an American computer. My son recently bought a game disk for it. You know, one of these things where monsters come out of the sky and you shoot them down. It's a great piece of programing. The only thing is, it was developed in Tokyo. That scared the hell out of me. Because the one edge we've had in the computer industry has been our software capability.

The Japanese have mounted a $100 million program to increase the software creation capability of Japan.

We have nothing like that. The private sector is doing well. How well it will be doing 5 years from now is an open question. I hope that I will not be called upon to testify before this subcommittee of the Finance Committee when the computer industry comes to the Congress the way the shoe industry did in 1978 or 1977 when I first got here.

Mr. Chairman, I think there is a role where the Republican Members of the Congress can help a Republican administration insure the validity of the program that the President has taken without violating either political philosphy or without exeeding the cap on the budget, and I can only urge them to do that.

Mr. **Walgren**. Let me ask. You had indicated that the generic technologies would not be picked up by individual firms because of their nature. As someone who really doesn't have a background in technology, how would you describe the kinds of things that would be done in a generic technology center versus the kind of things that business might be expected to pick up on its own?

Dr. **Baruch**. Let me draw on past experience for that. I used to be treasurer and director of R. & D. for a corporation. It's a consulting firm in Cambridge, but it developed products as well. When we reached decisions internally on how to spend our R. & D. funds, we chose those things that in our firm could have a relatively short payout time in which we could develop a proprietary position and things that provided an element of growth for the corporation. Three areas.

They were tasks that were unique to our company. We looked for a new processor; not a new way of processing information, but a new processor that we could produce for intercommunication. That company, others like it, with the possible exception of an IBM, are unable and unwilling to work on the higher risk, longer term payout kind of developments that are critical if we are to advance.

In the solid-state electronics field, for example, we now know how to put several hundred thousand computer elements on a single chip. What we don't know is what to do with them once we've got them there.

We need a program to assist designers to design circuits that have specific functions on such chips. That design problem is enormous and will get worse when we get to the 1-million element chips. The task of designing a large computer on a chip is a phenomenal one. No single company can afford to do any more than the individual dog work of designing such a computer that they are going to make. But our computer industry could move ahead a gigantic step were we to develop the kind of technology that would automate that design process so that one might write a large software program and then convert that software program into a hardware configuration. That's one area.

A different area: We spend an enormous amount of money in this country replacing rusty pieces of metal, whether they are in cars or in bridges. Companies work very hard on making a particular kind of steel rust resistant, corrosion resistant. But for us to tackle the problem of how do we beat corrosion—are there coatings? Are there electrical processes? I don't know the answers. That's what we need a center for. To reduce corrosion could have a payoff to this country that's phenomenal.

Substitute materials that Senator Schmitt mentioned yesterday. I mentioned before that when all you've got is a hammer everything looks like a nail. If you're in the brass business you try to solve all your problems with brass. If you're used to using cobalt in steel you're worry is how you get more cobalt.

We need a central effort to decide where can we—not to decide, but to work on applying our technical knowledge to developing substitutes for the critical materials that we know we're going to be without.

Those are what I call generic technologies.

A witness yesterday said the centers ought to be industry oriented rather than technology oriented. That's a question on which I'm relatively neutral.

There are certainly some areas, as in the solid-state electronics, where they probably ought to be industry oriented. There are others, as in corrosion, where they probably ought to be technology oriented. But each of these kinds of technologies, Mr. Walgren, is a technology that an individual company or even an industry working together under reduced antitrust regulations will not tackle. And I speak as somebody who used to allocate funds for R. & D. in a company. We will not do it. My clients won't do it. I will advise them not to do it. It makes poor business sense. It makes marvelous business sense for the Government to catalyze that growth, because the benefits to the public are enormous.

Mr. **Ertel**. Thank you.

Mr. Skeen?

Mr. **Skeen**. Thank you, Mr. Chairman.

Dr. Baruch, I think your presentation was excellent and very wise and very basic. Being the only Republican member on this committee present today, I am compelled to talk politics, yet I'm not here to defend any so-called political philosophy or anything of that kind. I leave that to my astute members of the majority. I would remind you, however, that we didn't get into the jam we're in in industry in the United States overnight.

Dr. **Baruch**. Right, sir.

Mr. **Skeen**. We've got 30 or 40 years of erudite introspection into the problem from both Republicans and Democrats. However, philosophies of the past haven't really adjusted themselves to our style and rate of growth or to the changes as readily as they should.

I think that the Stevenson Wydler Act makes good sense. It's a good approach. Unfortunately the problem that I believe we're facing today is a disease that is far deeper than could be remedied by one approach. I appreciate what you said in the charge made to the Republican side as far as ideological input to the administration. I think they'd agree with you too. But the problems that we face today, as far as budgets and taxes, need a broader based remedy than, say, one technological program.

Dr. **Baruch**. Absolutely, Mr. Skeen.

Mr. **Skeen**. I think we agreed on that. Unfortunately, fiscal austerity seems to be receiving all the focus. I don't appreciate having to cut programs that I think are great. But there are 435 Members of this body and when it comes down to the last line the majority of them are going to rule. And I can agree with Mr. Ertel on one case and violently and vehemently disagree with him on another, which we do often. But I still respect his rights. This system works this way and you know it as well or better than I do.

I would like for every program that I think would make a great contribution to technology transfer to be funded at the very fullest level.

I have a great deal of faith in the work of the National Science Foundation and the Bureau of Standards. I'm new here. I am privileged to widen my horizons right along with these folks that have had a lot of experience and I can sympathize and empathize with exactly what you said about what the administration should be funding. Unfortunately, we don't arrive at basic policy this way. We don't even have a good energy policy in this country. I think that I've got some real good answers. I'm sure that you've got many better ones.

I will go by the White House and tell them—if it's helpful, that I would go to bat for this program. It's not a matter of Republican philosophy or Democratic philosophy; it's a question of how we get out of this mess in a broad-based way I think that's what the administration is trying to do.

Dr. **Baruch**. Mr. Skeen, I couldn't agree with you more. The administration's broad-based policies are going to industry's willingness to invest in new technologies. I want to increase their ability as well as their willingness.

Mr. **Skeen**. I agree with you totally.

Dr. **Baruch**. And I think your access to the White House can be more useful than your trying to convince 400—218 of your fellow Congressmen, because if the administration will reverse its position and request these funds for 1982, and I think they can easily within the cap and without endangering anything, I think the problem is solved. Because I think the Congress will go along with the administration's request on a broad bilateral basis. And if I can be of any help, despite the fact that I'm tarred with a Democratic brush but still have an academic and businessman's view of things, I'd be glad to offer my help.

Mr. **Skeen**. I appreciate that and I take the charge seriously. I think that we do have that kind of input. We have changed their minds. I don't know how influential one person can be, or whether it depends on what part of the country you're from at the present time or how badly they need the vote right now. [Laughter.]

Dr. **Baruch**. You may be new here but you've learned awful fast. [Laughter.]

Mr. **Skeen**. I'm like the village idiot and the hot horseshoe—it didn't take me long to look at it. [Laughter.]

I do appreciate what you're saying. I'll just make this one last statement and get off this. The cutting edge of the industrial effort that we have in the United States is our technology, and for far too long I think that we've been intimidated by our own technology because it has led us to become a very affluent Nation. We've been apologizing for this for too many years now, and it's about time that we began to believe in ourselves once again. And the only support, the base support, of that is our technological expertise.

Dr. **Baruch**. Mr. Skeen, let me add one thing that the COGENT centers does that I think is particularly important for a Republican administration. It provides—in addition to the creation of new technology, it provides a forum for Government and industry to work together for a common public cause in a productive way that can do a great deal to eliminate or reduce this kind of adversary relationship that has contributed to the 30 or 40 years of decay that we've seen in our own industrial structure. And I think it is a worthwhile start even there.

Mr. **Skeen**. Dr. Baruch, let me tell you this, too. Republican or Democrat, we're all in the same boat and we all got to row it.

Dr. **Baruch**. Both ends of the ship are going down.

Mr. **Skeen**. That's right. I don't believe in grabbing the anchor to save yourself.

Thank you, sir. Thank you, Mr. Chairman.

Mr. **Ertel**. Thank you, Mr. Skeen.

I don't know why I'm the one that's always in the violent arguments around here. [Laughter.]

You said I was in arguments with you and Mr. Skeen says he agrees with me sometimes and sometimes he doesn't. I agree with what you've said today, Dr. Baruch, just so we're on the same wavelength.

Let me ask you about your patent policy now.

Dr. **Baruch**. Yes, sir.

Mr. **Ertel**. Since you have departed from the restrictions of the OMB, are you still of the same view that we should not transfer the patents, basically the ownership rights to the contractor with a recoupment provision? Or have you changed your view since you are no longer under the restrictions of OMB?

Dr. **Baruch**. Let me answer that very deliberately. First, a small piece of background. I was able to make enough money in private industry so that I could come to work for the Government in part because of a series of patents that I developed, that my company owned, some of which were developed in part under Government funds but to which we retained title because that was a condition of the contract that we wrote. Despite that, I think that the direct transfer of title to the contractor would be a less beneficial solution than the transfer of exclusive licenses in specified areas, but with recoupment. I believe the Government ought to recoup.

I disagree with Senator Long who said if we want to raise money we ought to do it with taxes not by charging for things. I believe that we ought to have a recoupment provision. But the reason I specify exclusive licensing in fields of interest, which is what we discussed many times, is that there are many companies that could have used my own inventions beneficially but I never had the incentive to go out and license them. And licensing is not a passive thing any more than technology transfer is.

I think that Federal patents ought to be exlusively licensed to anybody who is going to push them because they have got to make enormous investments in them. And I don't think they ought to be exclusively licensed for 5 years. I think they ought to be exclusively licensed for the life of the patent. And I think the Federal Government ought to have the ability to go out and push the use of those patents in other industries that aren't competing with those exclusive licensees and contractors.

Now, I'm taking a stronger view, I realize, than your industrial witness did yesterday who said he didn't care about that because he's got the know-how and that's really what counts. And in fact that's true. But it's the know-how in one narrow area.

We developed a sound treatment, for example, for jet engine test cells, to quiet test cells. It was also used in the air-conditioning industry for quieting the air-conditioning systems. But in fact it could have been used in a wide range of industrial applications that were never looked at because we just didn't have the incentive; we had more work than we could do.

Mr. **Ertel**. Dr. Baruch, you've moved somewhat from the administration's position of last year.

Dr. **Baruch**. Today I'm giving you my position.

Mr. **Ertel**. I find it enlightening to say that we only have one real distinction and varience between us. And I really don't get hung up on the idea of whether it's title or exclusive license. They're the same thing in my judgment. It's like getting a 100-year lease or getting ownership——

Dr. **Baruch**. It's exclusive license in a particular field.

Mr. **Ertel**. That's what I'm coming to next, the field. I don't want to make this patent hearings, but still I think it is an important issue that somewhere has got to be resolved. When you talk about a field you make the assumption that the Government then will go out and market in the other field and they will do the licensing in those other fields.

Dr. **Baruch**. Yes.

Mr. **Ertel**. I guess the question then comes, Has the Government done a very good job of that or will they do a good job of it in the future? And I guess that's a policy or a judgmental factor that you and I might differ on. I might say that the Government won't do a very good job. On the other hand, if I think that you have a financial interest in licensing and you've got a return coming if you license in those other fields that you may do a good job of it if you're a Westinghouse or you're Baruch Enterprise, Inc., you may in fact do that and may do a better job than the Government.

Dr. **Baruch**. May.

Mr. **Ertel**. One thing we do know is that the Government hasn't done a very good job so far.

Dr. **Baruch**. But we also know that private industry hasn't done a very good job so far, Mr. Ertel. And what I'm recommending is that this not be a passive activity of the Government. If you fund CUFT you have an organization that's actively in the business of transferring and adapting technology. You put the Government's interest in those patents in that same group so that that becomes part of the body of technology that they are actively and intensely trying to move. I think you've got a very much better chance of the Government doing a good job than industry.

Remember something. In a company like General Electric, and I can speak about GE better than I can about Westinghouse since I used to be a general manager at GE, in a company like GE, to get management's attention, just to get managerial attention a project has to have a potential return greater than $5 million. It's just that simple.

Mr. **Ertel**. How do you get management's attention in the Federal bureaucracy?

Dr. **Baruch**. Mr. Ertel, one of the things I discovered since coming down here and something I haven't given up since leave is a recognition of a huge number of very competent people in the Federal bureaucracy who want to do a good job and are committed to doing it. And I will never again vote for a President who runs against the bureaucracy. There are a lot of people here who want to do a good job, who take pride in what they do. You've got some of them in this audience. And I think if you started CUFT, funded it and put Federal residual patent rights into it you'd have a fine situation.

Now, remember, a company that wants an exclusive license in fields of interest and sees that it can license—for example, if we were going to license the air-conditioning industry we would specify air-conditioning as well test cells, even if only licensing is the only thing we're going to do. But we wouldn't specify quieting diesel engines because that's just too little and too much work.

Mr. **Ertel**. It seems to me there's people on both sides that want to do a good job. The question is who is going to move it. So far we've seen Government has not done it. And I think that's a question.

Secondly, I would suggest to you that there are groups on the horizon. Prior to coming here I invested in a firm which went out and purchased patents. In fact marketed them and their aspects and licensed them. That was all they did. Their exclusive job was to license patent rights, and they did very well at it.

So it seems to me there is a group that can grow up that way. And they could do it with Federal patents as well if in fact they knew that they existed, and secondly, if they knew who they could negotiate with to get those rights and could do the licensing. They would go to a General Electric and say, we will license for you and do it on a percentage basis. Having been a lawyer, I'm used to contingent fee sort of deal. I would suspect that that might grow up much easier than it would through the Government.

Dr. **BARUCH**. It's certainly a possibility.

Mr. **ERTEL**. I'm glad to see that we're very close on our positions now, which has been a real change. I appreciate your coming in and thank you very much for your comments. I'm happy to have your testimony on the Stevenson-Wydler Act.

Dr. **BARUCH**. Thank you very much.

Mr. **ERTEL**. Our next witness is Dr. John Slaugher who is the Director of the National Science Foundation, and he will be accompanied by Dr. Donald Langenberg, Deputy Director of the National Science Foundation.

Mr. **WALGREN** [presiding]. Well, we want to welcome Dr. Slaughter, accompanied by Dr. Langenberg, the Deputy Director of the National Science Foundation; also Mr. Senich, Director of the Division of Industrial Science and Technology; and Mr. Kelly, who heads the Intergovernmental Programs Section.

We are glad you could come and join us in these hearings. Your written statement will be made part of the record. So proceed as you feel most comfortable, Dr. Slaughter.

[The biographical sketch of Dr. Slaughter follows:]

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

JOHN BROOKS SLAUGHTER
Director

Dr. John Brooks Slaughter was confirmed by the Senate to be Director of the National Science Foundation on September 23, 1980. He was nominated for the post by President Carter on July 3, 1980.

Before joining NSF Dr. Slaughter was Academic Vice President and Provost of Washington State University, Pullman, Washington. Prior to his appointment to Washington State University, Dr. Slaughter had been Assistant Director of the National Science Foundation for Astronomical, Atmospheric, Earth, and Ocean Sciences, a position to which he was nominated by President Carter on August 31, 1977.

As Assistant Director for AAEO, Dr. Slaughter was responsible for five NSF divisions--Earth Sciences, Ocean Sciences, Astronomical Sciences, Atmospheric Sciences and Polar Programs. The Directorate supports several major research programs such as the Global Atmospheric Research Program, the Ocean Sediment Coring Program, and the Arctic and Antarctic Programs. It also funds and administers a number of major national research laboratories.

Before assuming his NSF position, Dr. Slaughter was Director of the Applied Physics Laboratory and Professor in the Department of Electrical Engineering at the University of Washington at Seattle.

As Laboratory Director since 1975, he was responsible for the direction and management of a research and development program in ocean and environmental sciences and engineering. He initiated new programs in energy resource conservation and development, geophysics, environmental acoustics and bioengineering at the Laboratory. Under his direction, the staff of the Laboratory, a leader in the fields of underwater acoustics, underwater vehicles and physical oceanography, grew from 180 to 240.

Prior to going to the University of Washington, Dr. Slaughter was Head of the Information Systems Department of the Naval Electronics Laboratory Center (NELC) in San Diego, California. In that capacity he was responsible for the management of a 200-person staff engaged in the design and development of Navy command control and communication systems. Under his direction there, a major new emphasis in biomedical engineering was started. He was named Scientist of the Year at NELC in 1965 where he served from 1960 to 1975.

Earlier in his career, from 1956 to 1960, Dr. Slaughter was employed by the Convair Division of General Dynamics Corporation in San Diego where he worked on the development of missile flight instrumentation and telemetry equipment.

Dr. Slaughter was born in Topeka, Kansas, in 1934 and earned a Bachelor of Science degree in electrical engineering at Kansas State University in 1956. He earned a Master of Science degree at the University of California at Los Angeles (UCLA) in 1961. He also was awarded a Doctor of Philosophy degree in engineering science at the University of California at San Diego in 1971.

Dr. Slaughter has written widely in his field and is a member of several professional organizations including Eta Kappa Nu, the honorary electrical engineering society; Sigma Tau, the honorary engineering society; and the American Association for the Advancement of Science (AAAS). He has been Editor of the International Journal of Computers and Electrical Engineering since 1977. He is also a Fellow of the Institute of Electrical and Electronic Engineers (IEEE).

He served from 1968 to 1975 as Director and Vice-Chairman of the Board of the San Diego Transit Corporation, specializing in policy matters related to transit planning and technology. He was a member of the affiliate engineering faculty at San Diego State University from 1963 to 1965 and established graduate courses in discrete and optimal control systems. He was appointed to the San Diego Chamber of Commerce Energy Task Force in 1974 to advise on technological approaches to energy conservation.

Dr. Slaughter has been active in efforts to encourage minorities to pursue careers in science and engineering and has played a strong role in urging educational institutions, industry and government to take more aggressive steps to improve opportunities for minorities in those fields. In 1976, he was appointed a member of the National Academy of Engineering Committee on Minorities in Engineering.

Dr. Slaughter is married and has two children.

September 1980

TESTIMONY OF DR. JOHN B. SLAUGHTER, DIRECTOR, NATIONAL SCIENCE FOUNDATION, ACCOMPANIED BY DR. DONALD N. LANGENBERG, DEPUTY DIRECTOR; DR. DONALD SENICH, DIRECTOR, DIVISION OF INDUSTRIAL SCIENCE AND TECHNOLOGY; AND DR. EDWARD T. KELLY, HEAD, INTERGOVERNMENTAL PROGRAMS SECTION

Dr. SLAUGHTER. Thank you, Mr. Chairman.

The previous witness, Dr. Baruch, eloquently described the rationale for support of the Stevenson-Wydler Act. I have no intention to try to, nor could I, match his eloquence or his wit today, but I would like to talk about three points:

First, the historical role that the National Science Foundation has played in many of the areas being discussed by your Subcommittee.

Second, how NSF is being organized and how it is meeting some of the requirements of the act.

Third, the impact of budget cuts on the National Science Foundation and its ability to perform activities not only outlined in the Stevenson-Wydler Act but also, planned by NSF in programs concerned with innovation, productivity and technology transfer.

I also will stress, Mr. Chairman, the issues that you asked me to consider in sections 8, 11, and 13 of the act.

For well over 10 years, NSF has been involved in matters related strongly to the content of the Stevenson-Wydler Act of 1980. NSF has been funding programs that can be considered as technology transfer since the inception of the Foundation. Specifically, since the early 1970's, many of the projects that NSF has supported in basic and applied research can be considered as early steps in a technology transfer activity.

Today, a number of activities are under way to meet the requirements of Public Law 96-480. Programs put into operation by NSF are designed to encourage industry and university interaction, to stimulate innovation, and to help support research in areas believed to be deserving of support, particularly in small, high-technology firms doing high-risk kinds of research.

In March, 1981, we reorganized the National Science Foundation. Included was a new division which will emphasize a number of the findings noted in section 2 of the Stevenson-Wydler Act.

The new unit is known as the Division of Industrial Science and Technological Innovation, headed by Dr. Donald Senich, who is at the table here with me. Its mission is to provide a strategic and managerial focus for almost all of the action-oriented programs that the Foundation conducts in this field.

The division operators four major programs:

First, an industry/university cooperative research program designed to encourage collaborative projects between industrial organizations and universities—project of mutual interest to the participants.

Second, small business innovation research program which is concerned with funding advanced high-risk research in small business firms. I will say a little bit more about that later.

Third, university/industry cooperative research centers where NSF and industry jointly fund research activities compatible with university objectives and industrial organization needs.

Fourth, an innovation processes research program concerned with improving knowledge and understanding of technological innovation and how it is affected by Federal policies and practices, and by industrial interests.

NSF also has another unit in its Directorate for Scientific, Technological and International Affairs, the Division of Intergovernmental and Public Service Science and Technology, whose purposes are related to technology transfer. The division is concerned with intergovernmental programs in which the Federal Government and State and local governments can work together to improve the transfer of technological developments to areas of need, particularly in the State and local governments.

The Federal technology and information transfer program has been working with the 700 or so Federal laboratories to encourage the kind of communication between laboratories and agencies which is important to technology transfer. Since about 1971, NSF has provided a home base for the Federal Laboratory Consortium, Federal technology transfer activities have been coordinated at NSF headquarters.

Finally, I want to make certain you are fully aware that budgetary actions for fiscal year 1982 reduce many of the activities initiated by NSF and provided a basis for many sections of the Stevenson-Wydler Act. However, we feel, as we did even before the act was passed in 1980, that we should use NSF's basic mission to continue what we believe to be an important effort in technology transfer.

Let me turn quickly now, Mr. Chairman, to sections 8, 11, and 13.

Section 8 called for the National Science Foundation to provide assistance for the establishment of centers for industrial technology. The university/industry cooperative research centers program is a movement in that direction by the Foundation. NSF support is used to help develop broad interdisciplinary research programs at universities. We provide planning grants for study of alternative approaches to the development of centers which, in turn, can address industry needs through unviersity expertise and capability.

One such center has become famous for its contributions to industry, the Polymer Processing Center at the Massachusetts Institute of Technology. It has now become self-sufficient and is being supported completely by industry even though it was started with support from the National Science Foundation.

Another center, the Computer Graphic Center at Rensselaer Polytechnic Institute, is in its third year and is receiving approximately 60 percent of its support from industry. The Center for Welding Research at Ohio State and the Center for Industry Research on Polymers at the University of Massachusetts at Amherst are also receiving approximately 60 percent of their support from industry. The Center for Applied Polymer Research at Case Institute of Technology in Cleveland is just getting underway, but already it is receiving half of its support from industry. For all of these centers, industry is providing a total of about $2 million a year to continue this important research.

Section 11 required each Federal laboratory to establish an Office of Research and Technology Applications if the laboratory's budget exceeded $20 million. The National Science Foundation operates through contracts to the universities six national centers. Most of these are astronomy centers; the sixth one is the National Center for Atmospheric Research (NCAR) in Boulder, Colo. One of those centers has a budget in excess of $20 million.

The National Science Foundation has seen to the establishment of an Office of Research and Technology Application at NCAR, staffed by a full-time employee in consonance with the mandates of the act.

The other centers also have established such offices and are doing what they can within their missions to see that technology transfer is a conscious decision of the management.

Section 13 of the act is concerned with cooperation between the Department of Commerce and the National Science Foundation for establishing a joint program of scientific and technical personnel exchanges. Last December, the two agencies jointly held a conference in St. Louis to which deans of engineering and business schools at many of the Nation's leading universities were invited. Our purpose was to discuss policy and to consider curricula important improving the universities' abilities to prepare young people for careers in technology and management.

Congressman Brown was a speaker at the conference. He did an exceptional job in explaining to the deans of engineering and business colleges the perspective of the Congress on the issues being discussed at the conference.

The proceedings of the conference have been published and will become a basis for much of what we do in stimulating innovative practices and technical management in the colleges and universities.

NSF has also provided support for about 100 college and university science teachers to participate in industry, Government, and nonprofit laboratory programs. We believe it is critically important for these teachers to bring technical knowledge and skills to the classroom.

NSF is pleased to support this effort, and I am convinced that it will continue to be a part of NSF's program.

Under the industry/university cooperative research projects program, Mr. Chairman, we have made about 100 awards per year. In deciding what projects to support, we look at the input of the industrial organization and the class of industries affected by the kind of research to be conducted. The performance of the research is guided by the needs of industry and by the capabilities of the university organization. This is a very important program, one that has certainly shown the possibility of joint research activities by university and industrial organizations.

I mentioned earlier the small business innovation research program and the high payoff derived from support of high-risk programs in small businesses. The NSF program is supported by funding in three phases. The first is a planning phase in which NSF awarded $30,000 to each of about 80 small businesses in fiscal year 1981. In phase 2, those programs that appear to have the greatest merit are provided higher levels of funding. NSF will fund about 12 to 15 such projects in fiscal year 1981, with a total of about $2½ million. In the third phase, venture capital from the private sector is used to continue the research activity. The NSF program request for fiscal year 1982 is about $5 million

Mr. Chairman, NSF has a total of about $19 million in fiscal year 1981 for the programs that I have discussed. The budget amendments planned for fiscal year 1982 will reduce that number to about $17 million. We believe, however, that important activities are contained in the area of technology transfer and innovation development. The National Science Foundation is committed to identifying and exercising its role in this area, and we will do all that we can to work with your subcommittee in helping to develop these activities.

[The prepared statement of Dr. Slaughter follows:]

STATEMENT OF
DR. JOHN B. SLAUGHTER
DIRECTOR, NATIONAL SCIENCE FOUNDATION
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
OF THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

JULY 15, 1981

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I AM PLEASED TO REPORT TO YOU ON THE ACTIVITIES UNDER WAY AT THE NATIONAL SCIENCE FOUNDATION THAT MEET THE REQUIREMENTS OF PUBLIC LAW 96-480, "THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980."

THE PROBLEM OF RESTORING THE VIGOR OF INNOVATION, PRODUCTIVITY, AND ECONOMIC GROWTH IN OUR SOCIETY IS A COMPLEX ISSUE. THE ROLE OF THE FOUNDATION IN THAT PROCESS IS UNIQUE, AND THAT ROLE IS DIFFERENT IN IMPORTANT WAYS FROM ALL OTHER FEDERAL AGENCIES. THE FOUNDATION DOES NOT ITSELF OWN OR OPERATE RESEARCH FACILITIES NOR DOES ITS MISSION INCLUDE ACTIVITIES FOCUSSED PRIMARILY AND DIRECTLY ON DEVELOPMENT OF TECHNOLOGY. WE HAVE NO LABORATORIES IN THE SENSE THAT THE NATIONAL INSTITUTES OF HEALTH AND DEPARTMENT OF ENERGY HAVE LABORATORIES -- THOUGH MOST OF OUR PROFESSIONAL STAFF ARE SCIENTISTS. THE MANDATE OF THE FOUNDATION IS PRIMARILY TO MAINTAIN THE NATION'S STRENGTH IN SCIENCE AND ENGINEERING THROUGH SUPPORT OF MOSTLY BASIC, BUT ALSO APPLIED RESEARCH. THE FOUNDATION PROVIDES ONLY A THIN SLICE OF THE TOTAL RESOURCES MADE AVAILABLE BY THE FEDERAL GOVERNMENT TO UNIVERSITIES AND COLLEGES FOR RESEARCH AND EDUCATION. NEVERTHELESS, THAT SLICE IS A CRITICAL ELEMENT IN THE INNOVATION CHAIN THAT LEADS FROM THE LIBRARY AND THE LABORATORY OUT INTO THE MARKETPLACE.

THE FOUNDATION IS CONCERNED WITH THE APPLICATION OF SCIENTIFIC AND ENGINEERING KNOWLEDGE. ITS ROLE IS NOT PRIMARILY AS AN ACTIVE TECHNOLOGY TRANSFER AGENT; RATHER IT CONTRIBUTES BY STRENGTHENING THE REQUIRED SCIENCE AND ENGINEERING KNOWLEDGE BASE AND BY INCREASING UNDERSTANDING OF THE TECHNOLOGY TRANSFER PROCESS ITSELF THROUGH RESEARCH AND EXPERIMENTATION WITH MECHANISMS.

TECHNOLOGY TRANSFER CAN BE ACCOMPLISHED IN MANY DIFFERENT WAYS. THE FOUNDATION FUNDS PRINCIPALLY RESEARCH PROJECTS AND MOST OF WHAT WE ACCOMPLISH IN SUPPORTING RESEARCH ULTIMATELY RELATES TO TECHNOLOGY TRANSFER, THOUGH MUCH OF IT WAS NOT DESIGNED WITH THAT IN MIND. FOR EXAMPLE, SINCE THE ESTABLISHMENT OF THE FOUNDATION IN 1950, THE FOUNDATION'S SUPPORT OF BASIC RESEARCH IN UNIVERSITIES HAS INCREASED THE ABILITY OF UNIVERSITIES TO SUPPORT GRADUATE STUDENTS BY INCLUDING THEM IN STATE-OF-THE-ART RESEARCH PROJECTS. THESE STUDENTS SUBSEQUENTLY TRANSFER THIS UP-TO-DATE KNOWLEDGE INTO APPLIED INDUSTRIAL RESEARCH AND DEVELOPMENT AS THEY ENTER PRIVATE EMPLOYMENT. THE FOUNDATION ALSO DELIBERATELY INCLUDES FINANCIAL SUPPORT FOR THE PUBLICATION OF THE RESULTS OF THE RESEARCH THAT HAS BEEN ACCOMPLISHED. FURTHERMORE, AS THESE BASIC RESEARCH RESULTS BECOME RELEVANT TO THE NEEDS OF THE PRIVATE SECTOR, AND NEW OPPORTUNITIES ARISE IN INDUSTRIAL RESEARCH LABORATORIES, UNIVERSITY INVESTIGATORS MAY TURN TO VERY PRACTICAL AND VALUABLE TASKS IN THE UNIVERSITY OR AS CONSULTANTS TO INDUSTRY.

WHILE THE PRINCIPAL MODES OF "TECHNICAL TRANSFER" EMPLOYED BY THE FOUNDATION ARE THOSE I HAVE JUST DESCRIBED, WE HAVE NOT NEGLECTED MORE DIRECT PROGRAMMATIC EFFORTS.

A NUMBER OF THE NATIONAL SCIENCE FOUNDATION'S EXPERIMENTAL PROGRAMS ARE DIRECTLY RESPONSIVE TO AND INDEED HAVE PROVIDED A SUBSTANTIVE BASIS FOR MANY SECTIONS OF P.L. 96-480. THESE PROGRAMS ARE DESIGNED TO ENCOURAGE INDUSTRY/UNIVERSITY INTERACTION TO STIMULATE INNOVATION BASED ON UNIVERSITY RESEARCH

THAT IS RESPONSIVE TO INDUSTRY'S REQUIREMENTS, AND THROUGH SUPPORT OF RESEARCH IN SMALL, HIGH-TECHNOLOGY FIRMS.

THE ESTABLISHMENT OF A NEW DIVISION IN THE DIRECTORATE FOR SCIENTIFIC, TECHNOLOGICAL, AND INTERNATIONAL AFFAIRS ON MARCH 8, 1981, HIGHLIGHTS NSF'S AWARENESS OF THE IMPORTANCE OF THE FINDINGS NOTED IN SECTION 2 OF THE ACT.

THE DIVISION OF INDUSTRIAL SCIENCE AND TECHNOLOGICAL INNOVATION (ISTI) ADDRESSES THE SPECIAL RELATIONSHIP BETWEEN UNIVERSITY AND INDUSTRIAL RESEARCH AND TECHNOLOGICAL INNOVATION. THIS DIVISION PROVIDES A STRATEGIC AND MANAGERIAL FOCUS FOR VIRTUALLY ALL OF THE ACTION-ORIENTED PROGRAMS IN THE NSF THAT INVOLVE INDUSTRY, ENCOURAGE UNIVERSITY/INDUSTRY INTERACTION FOR RESEARCH, AND STUDY THE PROCESSES AND ISSUES OF INDUSTRIAL SCIENCE AND TECHNOLOGICAL INNOVATION.

THE FOUR MAJOR PROGRAMS OF THIS DIVISION ARE AS FOLLOWS:

O THE INDUSTRY/UNIVERSITY COOPERATIVE RESEARCH PROJECTS PROGRAM ENCOURAGES COLLABORATIVE RESEARCH PROJECTS IN SCIENCE AND ENGINEERING THAT ARE OF MUTUAL INTEREST TO UNIVERSITY AND INDUSTRY RESEARCHERS AND HAVE POTENTIAL IMPORTANCE FOR NEW TECHNOLOGIES AND INNOVATION.

O THE SMALL BUSINESS INNOVATION RESEARCH PROGRAM FUNDS ADVANCED, HIGH-RISK RESEARCH DONE BY SMALL BUSINESS FIRMS IN A UNIQUE THREE-PHASED PROGRAM.

O THE UNIVERSITY/INDUSTRY COOPERATIVE RESEARCH CENTERS PROGRAM FUNDS JOINTLY WITH INDUSTRY THE INITIATION OF NON-PROPIETARY UNIVERSITY RESEARCH PROGRAMS THAT ARE BOTH COMPATIBLE WITH UNIVERSITY OBJECTIVES AND RESPONSIVE TO INDUSTRY'S RESEARCH NEEDS.

O THE INNOVATION PROCESSES RESEARCH PROGRAM SUPPORTS AND

CONDUCTS RESEARCH AND ANALYSIS AIMED AT IMPROVING OUR UNDERSTANDING OF HOW TECHNOLOGICAL INNOVATION AND TECHNOLOGY TRANSFER OCCUR AND HOW THEY ARE AFFECTED BY FEDERAL POLICIES AND PRACTICES.

ANOTHER DIVISION IN OUR DIRECTORATE FOR SCIENTIFIC, TECHNOLOGICAL AND INTERNATIONAL AFFAIRS, THE DIVISION OF INTERGOVERNMENTAL AND PUBLIC SERVICE SCIENCE AND TECHNOLOGY (IPSST), ALSO MAKES AN IMPORTANT CONTRIBUTION TO THE IMPLEMENTATION OF THIS ACT.

THE INTERGOVERNMENTAL PROGRAMS WERE DESIGNED TO FACILITATE THE ACQUISITION AND USE OF SCIENTIFIC AND TECHNOLOGICAL RESOURCES BY STATE AND LOCAL GOVERNMENT UNITS FOR USE IN POLICY PLANNING AND DECISION-MAKING PROCESSES.

THE FEDERAL TECHNOLOGY AND INFORMATION TRANSFER IN IPSST ARE SPECIFICALLY DESIGNED TO SECURE THE MAXIMUM USE OF FEDERALLY FUNDED SCIENCE AND TECHNOLOGY FROM THE OVER 700 LABORATORIES AND CENTERS OF TWELVE FEDERAL AGENCIES. THE PROGRAM ENCOURAGES INTER-LABORATORY AND INTER-AGENCY COMMUNICATION OF IDEAS AND TECHNOLOGY IN ORDER TO TRANSFER FEDERALLY DEVELOPED SCIENCE AND TECHNOLOGY TO STATE AND LOCAL GOVERNMENTS AND INDUSTRY. WE HAVE PROVIDED A HOME FOR THE MANAGERS OF THE FEDERAL LABORATORY CONSORTIUM, WHICH COORDINATES FEDERAL LABORATORY TECHNOLOGY TRANSFER ACTIVITIES.

IT SHOULD BE NOTED THAT BUDGET CONSTRAINTS FOR FY 1982 HAVE REQUIRED A REDUCTION OF MANY FOUNDATION ACTIVITIES THAT ARE NOT DIRECTLY RELATED TO OUR MAIN TASK OF PROVIDING SUPPORT FOR RESEARCH. AS A RESULT NO FUTURE FUNDING IS PLANNED FOR THE INTERGOVERNMENTAL PROGRAMS. HOWEVER, THE FOUNDATION WILL CONTINUE TO MEET THE OBJECTIVES STATED IN THE ACT WITHIN BUDGET LIMITATIONS. WE WILL ALSO CONTINUE TO PROVIDE A BASE FOR THE FEDERAL LABORATORY CONSORTIUM, BUT WITH NO PROGRAM SUPPORT FUNDS.

I WOULD LIKE NOW TO ADDRESS EACH SECTION OF THE ACT IN WHICH NSF

HAS SPECIFIC RESPONSIBILITIES.

SECTION 8 OF THE ACT MAKES PROVISION FOR NSF TO PROVIDE ASSISTANCE FOR THE ESTABLISHMENT OF CENTERS FOR INDUSTRIAL TECHNOLOGY. NSF'S UNIVERSITY/INDUSTRY COOPERATIVE RESEARCH CENTERS PROGRAM IS PROVIDING ASSISTANCE TO INITIATE SUCH CENTERS. OUR INITIAL SUPPORT ALLOWS A UNIVERSITY TO DEVELOP A BROAD INTERDISCIPLINARY RESEARCH PROGRAM THAT CAN BE RESPONSIVE TO THE SCIENTIFIC NEEDS OF A GROUP OF INDUSTRIES AND CAN GAIN SUFFICIENT INDUSTRIAL SUPPORT TO BECOME SELF SUSTAINING. GRANTS ARE AVAILABLE FOR POTENTIAL CENTERS TO STUDY ALTERNATIVE INSTITUTIONAL ARRANGEMENTS, MANAGEMENT STRUCTURES, AND RESEARCH PROGRAMS TO DETERMINE A CENTER ORGANIZATION LIKELY TO GAIN BROAD INDUSTRY INTEREST AND FINANCIAL SUPPORT. ONE CENTER, THE POLYMER PROCESSING CENTER AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY, HAS BECOME SELF SUFFICIENT WITH INDUSTRY FUNDING ONLY. FOUR CENTERS HAVE BEEN INITIATED AND ARE BEING JOINTLY FUNDED WITH INDUSTRY. THE CENTER FOR COMPUTER GRAPHICS AT RENSSELAER POLYTECHNIC INSTITUTE IS STARTING ITS THIRD YEAR AND RECEIVES APPROXIMATELY 60 PERCENT OF ITS SUPPORT FROM INDUSTRY. THE CENTER FOR WELDING RESEARCH AT OHIO STATE UNIVERSITY AND THE CENTER FOR INDUSTRY RESEARCH ON POLYMERS AT UNIVERSITY OF MASSACHUSETTS/AMHERST ARE IN THEIR SECOND YEAR OF OPERATION AND ALSO RECEIVE APPROXIMATELY 60 PERCENT OF THEIR SUPPORT FROM INDUSTRY. THE CENTER FOR APPLIED POLYMER RESEARCH AT CASE WESTERN RESERVE UNIVERSITY HAS JUST STARTED, WITH ABOUT HALF ITS FUNDS COMING FROM INDUSTRY. INDUSTRY IS ALREADY PROVIDING OVER $2 MILLION ANNUALLY FOR THESE FIVE CENTERS.

IN ADDITION, WE ARE STUDYING THE FEASIBILITY OF ESTABLISHING NEW CENTERS IN FIELDS SUCH AS TELECOMMUNICATIONS, FLUIDIZED BED PROCESSING, CERAMICS, SIGNAL PROCESSING, MATERIALS HANDLING, AND MICROCOMPUTERS.

SECTION 9 OF THE ACT SPECIFIES THAT NSF SHALL, ON A CONTINUING BASIS, OBTAIN THE ADVICE AND COOPERATION OF DEPARTMENTS AND

AGENCIES WHOSE MISSIONS CONTRIBUTE TO OR ARE AFFECTED BY THE PROGRAMS ESTABLISHED UNDER THIS ACT. IT ALSO NOTES THAT THE DEPARTMENT OF COMMERCE AND THE NSF SHALL, ON A CONTINUING BASIS, PROVIDE EACH OTHER THE OPPORTUNITY TO COMMENT ON ANY PROPOSED PROGRAM. THE ADVICE AND COOPERATION OF OTHER DEPARTMENTS AND AGENCIES HAS BEEN SOUGHT AS APPROPRIATE. EACH NSF PROPOSAL FOR A UNIVERSITY/INDUSTRY COOPERATIVE RESEARCH CENTER HAS BEEN REVIEWED BY THE DEPARTMENT OF COMMERCE AND OTHER APPROPRIATE AGENCIES. A NUMBER OF COOPERATIVE GENERIC TECHNOLOGY CENTER PROPOSALS WERE SUBMITTED FOR REVIEW BY THE DEPARTMENT OF COMMERCE TO NSF. BECAUSE OF FISCAL CONSTRAINTS, THIS DEPARTMENT OF COMMERCE PROGRAM WAS TERMINATED BEFORE FINAL ACTION ON THESE PROPOSALS.

NSF PERSONNEL HAVE ATTENDED A NUMBER OF MEETINGS HELD BY DOC TO COORDINATE THE ESTABLISHMENT OF ADMINISTRATIVE ARRANGEMENTS. THE LAST SUCH MEETING WAS HELD IN DECEMBER, 1980. NO ADDITIONAL MEETINGS HAVE BEEN SCHEDULED AT THIS TIME PENDING POSSIBLE REORGANIZATION IN THE DEPARTMENT OF COMMERCE.

SECTION 11 OF THE ACT MAKES PROVISION FOR EACH FEDERAL LABORATORY TO ESTABLISH AN OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS AND, IF THE FEDERAL LABORATORY BUDGET EXCEEDS $20 MILLION, PROVIDE AT LEAST ONE PROFESSIONAL INDIVIDUAL FULL TIME AS STAFF FOR THIS OFFICE. STARTING IN FY 1982, EACH AGENCY OPERATING OR DIRECTING ONE OR MORE FEDERAL LABORATORIES SHALL MAKE AVAILABLE NOT LESS THAN 0.5 PERCENT OF THE AGENCY'S RESEARCH AND DEVELOPMENT BUDGET TO SUPPORT THE TECHNOLOGY TRANSFER FUNCTION OF THE AGENCY.

THE DEFINITION OF FEDERAL LABORATORIES APPLIES TO SIX NATIONAL CENTERS SUPPORTED BY NSF. ONLY ONE OF THESE CENTERS HAS A BUDGET EXCEEDING $20 MILLION --- THE NATIONAL CENTER OF ATMOSPHERIC RESEARCH (NCAR). AN OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS HAS BEEN ESTABLISHED IN EACH OF THE SIX CENTERS. NCAR HAS ASSIGNED AN INDIVIDUAL AS THE TECHNOLOGY TRANSFER OFFICER. NSF WILL PREPARE AND SUBMIT THE BIENNIAL REPORTS ON THE

ACTIVITIES OF ITS CENTERS AS REQUIRED BY THIS SECTION.

SECTION 13 OF THE ACT AUTHORIZES THAT THE DEPARTMENT OF COMMERCE AND THE NATIONAL SCIENCE FOUNDATION SHALL ESTABLISH A JOINT PROGRAM TO FOSTER THE EXCHANGE OF SCIENTIFIC AND TECHNICAL PERSONNEL AMONG ACADEMIA, INDUSTRY, AND FEDERAL LABORATORIES. THESE JOINT EFFORTS WERE DISCUSSED IN THE COORDINATION MEETINGS LAST YEAR. NSF AND THE DEPARTMENT OF COMMERCE HAVE CO-SPONSORED A NATIONAL CONFERENCE FOR DEANS OF ENGINEERING AND BUSINESS COLLEGES IN DECEMBER 1980 FOR THE PURPOSE OF DISCUSSING POLICY AND TO CONSIDER CURRICULA IN AREAS OF ENTREPRENEURSHIP AND THE MANAGEMENT OF TECHNOLOGY. THE PROCEEDINGS OF THE WORKSHOP HAVE BEEN PUBLISHED AND WILL SERVE AS BASIS UPON WHICH THE UNIVERSITY COMMUNITY CAN BECOME MORE ACTIVE IN THE STIMULATION OF INNOVATIVE PRACTICES AND TECHNICAL MANAGEMENT. WHILE NO JOINT FORMAL PROGRAM HAS BEEN ESTABLISHED WITH THE DEPARTMENT OF COMMERCE, NSF HAS PROVIDED SUPPORT FOR ABOUT 100 COLLEGE AND UNIVERSITY SCIENCE TEACHERS TO PARTICIPATE IN RESEARCH PROGRAMS IN INDUSTRY, GOVERNMENT AND NON-PROFIT LABORATORIES. THESE AWARDS, TOTALLING $549,400 IN FY 1981, WERE MADE TO 23 RESEARCH LABORATORIES IN 12 STATES THROUGH THE INDUSTRIAL RESEARCH PARTICIPATION PROGRAM OF THE FOUNDATION'S DIRECTORATE FOR SCIENCE AND ENGINEERING EDUCATION. THE GOAL OF THIS PROGRAM IS TO BROADEN THE RESEARCH EXPERIENCE OF COLLEGE FACULTY MEMBERS SO THEY CAN IMPROVE THE QUALITY AND RELEVANCE OF THE COURSES THEY TEACH. THE LABORATORIES RECEIVING AWARDS ARE PERFORMING RESEARCH IN NATURAL ECOSYSTEMS, PHOTOSYNTHESIS, SOLAR ENERGY, COAL GASIFICATION, HYDROCARBON EXPLORATION, FIBER OPTICS, MAGNETIC MATERIALS, LASER PHOTOCHEMICAL ETCHING, ELECTRONIC STRUCTURES IN METALS, AND AEROSPACE TECHNOLOGY. UNDER OUR STRINGENT BUDGET POSTURE FOR FY 1982, THIS PROGRAM WILL BE ELIMINATED.

I WOULD LIKE TO PROVIDE SOME ADDITIONAL DETAILS ABOUT THESE IMPORTANT ACTIVITIES.

THE INDUSTRY/UNIVERSITY COOPERATIVE (IUC) RESEARCH PROJECTS

PROGRAM ASSISTS IN SUPPORTING INDUSTRIAL INNOVATION THROUGH THE FOSTERING OF COLLABORATIVE RESEARCH. SINCE THE INCEPTION OF THE IUC PROGRAM, COOPERATIVE PROJECTS BETWEEN UNIVERSITIES AND INDUSTRIAL FIRMS HAVE INCREASED OVER TENFOLD IN THE FOUNDATION, FROM 8 AWARDS PER YEAR TO APPROXIMATELY 100 AWARDS PER YEAR. IN COOPERATIVE PROJECTS, THE INNOVATION ASPECT IS PRESENT IN THE CONCEPTION, PERFORMANCE AND CONCLUSION OF THE PROJECT. THE CONCEPTION OF A COOPERATIVE PROJECT IS INFLUENCED BY THE PERCEPTION OF TECHNOLOGICAL NEEDS OR PROBLEMS. THE PERFORMANCE OF THE PROJECTS IS BOTH GUIDED BY AND FEEDS INTO RELATED TECHNOLOGICAL RESEARCH PROGRAMS OF THE INDUSTRIAL PARTICIPANT. RELEVANT RESEARCH INFORMATION IS TRANSFERRED DIRECTLY TO THE COOPERATING INDUSTRY THROUGHOUT THE COURSE OF THE PROJECT VIA ITS PARTICIPATING RESEARCHERS. OTHER FIRMS ARE ALSO INFORMED OF THE RESEARCH RESULTS, WHICH ARE MADE PUBLICLY AVAILABLE AND PUBLISHED.

OUR SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM SOLICITS HIGH-RISK RESEARCH PROPOSALS WITH A POTENTIALLY HIGH PAYOFF FROM SMALL CREATIVE SCIENCE AND TECHNOLOGY FIRMS. SBIR SERVES AS A SOURCE OF SEED FUNDING IN THE FIRST TWO OF THREE PHASES. PHASE I IS FOR FEASIBILITY STUDIES FOR EXPERIMENTAL OR THEORETICAL RESEARCH EFFORTS. WE WILL AWARD $30,000 TO EACH OF APPROXIMATELY EIGHTY SMALL BUSINESSES IN FY 1981. PHASE II FUNDING, FOR UP TO 24 MONTHS, IS PROVIDED FOR INNOVATIVE ADVANCED RESEARCH WHICH DEPENDS ON SUCCESSFUL COMPLETION OF PHASE I. TWELVE TO FIFTEEN AWARDS TOTALLING APPROXIMATELY $2.6 MILLION WILL BE MADE IN FY 1981. THE HIGHER COST PHASE III, CONDUCTED BY THE SMALL BUSINESS, IS SUPPORTED WITH PRIVATE VENTURE CAPITAL TO PURSUE COMMERCIAL APPLICATIONS THAT ARISE FROM RESEARCH CONDUCTED IN PHASES I AND II. THIS PROGRAM HAS GROWN SIGNIFICANTLY FROM AN NSF EXPENDITURE OF $1.0 MILLION IN FISCAL YEAR 1977 TO A PLANNED EXPENDITURE OF $5.0 MILLION IN FISCAL YEAR 1982.

OUR INNOVATION PROCESS RESEACH PROGRAM IS PERFORMING SEVERAL TYPES OF ACTIVITIES IN SUPPORT OF TECHNOLOGY TRANSFER. IT IS

SUPPORTING STUDIES OF VARIOUS GOVERNMENT POLICIES AND PRACTICES THAT HAVE AN IMPACT ON THE PROCESS OF INNOVATION. INCLUDED ARE STUDIES OF COMMERCIALIZATION, R&D MANAGEMENT, AND ISSUES RELATED TO TECHNOLOGY TRANSFER AND DISSEMINATION. IT IS ALSO CONDUCTING ASSESSMENT STUDIES FOR ALL THE INDUSTRIAL SCIENCE DIVISION'S ACTION PROGRAMS.

IN THE AGGREGATE THESE PROGRAMS WITH DIRECT TECHNOLOGY TRANSFER FUNCTIONS, WITH A BUDGET OF APPROXIMATELY $19 MILLION IN 1981 AND A PROPOSED BUDGET OF $17 MILLION FOR 1982, WILL MORE THAN MEET THE 0.5 PERCENT TARGET FIGURE FOR NSF, CONSISTENT WITH THE PROVISIONS OF THE ACT.

LET ME CONCLUDE BY SAYING THAT THE IMPORTANT FUNCTIONS SPECIFIED UNDER THIS ACT ARE RECOGNIZED BY NSF. OUR RECENT REORGANIZATION HAS AS ONE OF ITS PURPOSES TO IMPROVE OUR RESEARCH AND PROGRAMMATIC FUNCTIONS AS NOTED EARLIER IN MY TESTIMONY. IN SPITE OF THE EFFECT OF RECENT BUDGET CONSTRAINTS, I FEEL THAT NSF HAS BEEN AND IS BEING FULLY RESPONSIVE TO "THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980." I HOPE YOU AGREE WITH THIS ASSESSMENT.

Mr. WALGREN. Thank you very much, Dr. Slaughter.

I'd like to welcome a former member of this committee and now a member of the Appropriations Committee joining us here today. Wes Watkins of Oklahoma. The Chair will recognize Mr. Watkins, if you'd like to explore anything with the witness.

Mr. WATKINS. Thank you, Mr. Chairman. I appreciate the opportunity and indulgence for letting me come back.

Dr. Slaughter, welcome, and other members of the National Science Foundation.

I had such an interest in technoloy and also the involvement of NSF. I asked the chairman if I might come back for these hearings. You may wonder why this interest is so strong. It's primarily because of the need for innovation in maybe an unusual place, and that's in rural America, out in areas that, Dr. Slaughter, unfortunately often do not know that there is a National Science Foundation that exists. And unfortunately those who do, they've gotten a John Birch bulletin, something about one of those experiments—"why are we spending our money that way?" So we got a tremendous PR job to do in my area because there is no private sector and all of them even do not know that NSF has any role in small business because there hasn't been anything done in rural America by NSF. And we're trying to change that so we can take a very positive attitude and a positive approach about NSF to a lot of the people out there.

I think you and I recognize that we need that kind of public relation effort. And we're doing our best in the rural depressed areas of the country trying to involve NSF through small business activities and tech transfer. So we welcome you in the southern and eastern rural depressed area of Oklahoma where many counties do not have a single industry.

We're trying through industrial innovation and using technology to give birth to industry to build jobs there for people who vitally need them.

I'm concerned, real concerned. In the last 4 years, many people have felt like the NSF has literally put the technology transfer phase of their program to the back burner, and many times it's fallen off the back burner. I noticed in your testimony that its role is not primarily as an active technology transfer agent.

You know, the one-half percent we're trying to get in there for technology transfer and taking those four steps, which I'm going to talk about in a minute, sure isn't significant in most statisticians' books. But it is necessary. In all respect to NSF, as you and others lead that program down there, there's a lot of discussion about a National Technology Foundation being established. I truly believe it depends on the role that the leadership of NSF takes in trying to meet their requirements under the Stevenson-Wydler Act as well as putting technology up equal with science and research whether that technology foundation probably or definitely comes about.

Myself, I am holding back judgment to see basically how we respond. Let me get your feeling on that one question. I've got a couple of others.

Dr. SLAUGHTER. Certainly, Mr. Watkins. I and my colleagues at the Foundation are fully aware of and applaud your efforts. Having my origin in the State of Kansas, I understand what you are saying about rural America, and the lack of recognition of high technology in so much of that area, and the importance of addressing the problem. The National Science Foundation is committing more than one-half of 1 percent of its resources in this area, but I understand also the concern about the role of The Foundation in technology development. Let me say that I think we move smartly in addressing some of the issues that your colleague, Mr. Brown, has identified in his many discussions and presentations on the National Technology Foundation. We believe the National Science Foundation does have a role, and that role is best played in support for good engineering research. When we reorganized the Foundation, we established engineering research at the same level of importance as research in the mathematical and physical sciences, the biological and behavioral sciences, and the geophysical sciences.

Mr. WATKINS. Let me ask you, Dr. Slaughter, because I know we've got time allowances here, what are you doing since the Stevenson-Wydler Act differently than you did prior to the act to get that technology transferred out there to the people? I am speaking of more than just dissemination. Let me point out that section 11 of the Stevenson-Wydler Act states there are four functions: One, preparation for application of assessments on the projects; two, provide and disseminate information; three, cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community, and I'd like to say especially in rural depressed area; and four, provide technical assistance to the public sector in adapting federally developed technology for practical use.

What can you tell me or what could you tell the investigative arm of the Appropriations Committee, if necessary, how you're actually fulfilling the Stevenson-Wydler Act

Dr. **Slaughter**. I think the actions we have taken meet the requirement. We have established, for example, university-based innovation centers to provide information to the people in those regions, whether rural or urban areas, of the opportunities for improved skills for innovation in the development of businesses. The Foundation has responded——

Mr. **Watkins**. These were established before the act. We've got to take forth the dissemination of the work there and make sure we get it to that taxpayer whom we call on to fund NSF. I have to go out there every 2 years and ask them to fund NSF, which is a tough deal, unless we can prove some real positive things, which I'm trying to do. Because I believe in it strongly and I'm trying to do some things there in a very positive way.

Go ahead.

Dr. **Slaughter**. As I indicated earlier, much of what NSF has done was begun long before the act was passed. The Foundation has focused its programs somewhat so that they directly support the act's intent. And NSF has expanded its programs, particularly in the university-based innovation centers, to bring in the private sector. The small businesses in those regions are being involved in developing better skills, more knowledge about how to start businesses, and how to start technology development.

Mr. **Watkins**. Tomorrow morning we're probably going to have on the floor of the House, the Appropriations Committee, the funding of HUD and 10 agencies, 1 of the 10 agencies being NSF. Can I get on the floor and in all confidence tell the nearly 200-member delegation of the Congressional Rule Caucus that there is a strong effort, not only effort, but concrete evidence that NSF is responding to the last 4 years we've had in establishing an effort for technology transfer in rural America?

Dr. **Slaughter**. Yes, sir, I believe you can. And I believe I could bring people from outside the Foundation who would attest to that.

Mr. **Watkins**. I may have a couple more questions in a minute, Mr. Chairman. But I don't want to make enemies.

Mr. **Walgren**. Thank you, Mr. Watkins. Apparently we have three other witnesses after this board and so we ought to try to move directly.

Mr. Brown.

Mr. **Brown**. Dr. Slaughter, I think the thrust of your testimony is appropriately focused on the broad relationship of the Foundation to technology transfer. In a sense that is almost the essential purpose of the Foundation, the creation and dissemination of knowledge resulting in new technologies. And I would not argue with the excellence of the job the Foundation has done. We're really getting down to some fairly fine points here, mechanisms, and I think Congressman Watkins' questions focus on some of these mechanisms as they involve the constituency of interest to him, and without in the slightest degree wanting to put the Foundation on the spot or anything, I'd like to just ask you to comment on another aspect of that fine detail. Specifically, the Foundation has had that program on intergovernmental science and technology, as you well know, for some time aimed directly at the problem of transferring technology to State and local governments. And that is the wording of the Stevenson-Wydler Act. It's a key component of the act. And yet that specific program is being eliminated.

It's hard to conceive that the broader and highly important purposes of the Foundation are being focused on the transfer of technology to State and local governments, and I'm quoting from the act, when you've abolished the program that does that.

Now, could you respond to that?

Dr. **Slaughter**. Certainly, Mr. Brown. That is a fair question. As you know, the process by which programs are brought before the Congress by the administration for its consideration is a complex one. NSF made a strong argument for the intergovernmental science program. The administration determined that the budgetary situation for fiscal year 1982 made it necessary that we emphasize the support of basic and applied research in the major scientific categories of the Foundation's program.

The intergovernmental science program—public technology program—was one of those, not the only one reduced. In some cases, some aspects of those programs were eliminated in the administration's budget for fiscal year 1982. That did not lessen the importance of those aspects; and it does not lessen the need for mechanisms to provide that kind of support. But the decision placed NSF in the difficult position of trying to accomplish within its mission the programs that were contained in the President's budget.

Mr. **Brown**. I can't really fault the Foundation for carrying out the mandate of the administration. I can regret it. But I do not want to advise you to do anything different, except that I would not want you to try and present what you're doing as carrying out the mandate of Public Law 96-480 when really you've been instructed not to carry it out as far as that particular aspect is concerned. I would think it would be more realistic to recognize that that program is going to suffer at least temporary diminution and see if we can do something to recoup it later.

Mr. Chairman, I won't belabor the point further. I have very high regard for Dr. Slaughter's personal interest and concern with this area. I think he will do everything he can within the constraints that face the Foundation to attempt to carry out the intent of the law that we passed, but I recognize it may pose some problems for him.

Mr. **Walgren**. Thank you, Mr. Brown.

Mr. Weber?

Mr. **Weber**. I have no questions.

Mr. **Watkins**. Mr. Chairman, may I enter for the record some other questions in writing that might be part of the record this morning and not belabor all of them. But I would like to comment on the last paragraph of your statement, about more than fulfilling the technology transfer requirements of the act.

Four technology transfer functions are required. I think that whoever does this analysis for you should take it in that perspective of those four functions because they may be misreading or misjudging Public Law 96-480, section 11.

Mr. Chairman, thank you.

Mr. **Walgren**. Those questions will be entered as part of the record and we will submit them to get a direct response to them, also for the record.

Dr. Slaughter, I wanted to simply ask, on page 8, the bottom of your testimony, you raise the fact that the "innovation process research program is performing several types of activities in support of technology transfer. It is supporting studies of various government policies and practices that have an impact on the process of innovation."

It is my understanding that that particular function was directed toward the Department of Commerce. The NSF's attention was particularly directed toward the concept of funding of centers, personnel exchange and, I'm told, technology transfer. But that's what we're after all in all. But in particular the NSF, it was said under the act that it should work on those three and that policy studies would be left to the Department of Commerce. And yet the one's that NSF was specifically directed toward are in those areas of the budget that can't be fully funded this year and yet you are funding the policy studies aspects of it. I guess we're all a little suspicious of studies because so many don't seem to go anywhere or really contribute a great concrete change in the future.

How much money is being spent on that aspect of that particular program and are you sure that has the proper priority in view of the other things that we are not doing this year?

Dr. **Slaughter**. Mr. Chairman, it might be best if I gave Dr. Senich an opportunity to react directly to that question since he is concerned with that part of NSF's program.

Dr. **Senich**. Mr. Chairman, the portion of the program added to my division during the reorganization was previously a part of the Division of Policy Research and Analysis. This innovation processes research section serves a bridging function; it examines not only through extramural and intramural studies but also assesses the various programs which we are undertaking.

A specific example which reflects the best interests of this act is a study we are funding at the University of California at Santa Clara by Bruno and Tyebjee. The investigators are working closely with venture capital firms on the west coast, trying to determine what factors encourage a venture capital group to make an investment.

We are still collecting data, and our investigators are closely involved with the venture capital firms. They are walking through the decisionmaking process with the venture capital people to check on how their interests are focused. We are learning several things; for example, the statement always has been made that we can't find a place to put our money. The investigators are saying, "Well, maybe they don't really understand the technology."

What Bruno and Tyebjee are doing is the front end of the the intramural studies which will then lead to a better understanding of the total small business research program. The work does have a function directly related to the program of technology innovation on the assessment side.

Other items we are looking at are industrial innovation and organizational behavior and innovation dissemination, important elements of the act. So studies for the sake of studies are not the interest here. It's studies as stepping stones to a better understanding of the innovation process. The amount of money is $1.1 million in fiscal year 1981. We anticipate in fiscal year 1982 about $1 million, a small portion of the overall funding of the division, yet important because it allows us to examine innovative mechanisms.

Mr. WALGREN. I appreciate that answer.

Well, I have nothing further and the others do not.

We want to thank you very much, gentlemen, for coming and we look forward to seeing you again.

Dr. SLAUGHTER. Thank you.

[Dr. Slaughter's answers to questions from the subcommittee and Mr. Watkins follow:]

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OFFICE OF THE
DIRECTOR

September 18, 1981

Honorable Doug Walgren
Chairman
Subcommittee on Science,
Research and Technology
Committee of Science and Technology
U. S. House of Representatives
Suite 2321 RHOB
Washington, D.C. 20515

Dear Mr. Walgren:

I was pleased to be able to discuss the role of the Foundation in the implementation of the Stevenson-Wydler Technology Innovation Act with the Subcommittee on Science, Research and Technology.

The attached sheets contain answers to the additional questions transmitted to me in your letter of July 23, 1981. I trust that they supply the information needed to complete the record.

Sincerely yours,

John B. Slaughter

John B. Slaughter
Director

Attachments

Questions Submitted by Committee

1. QUESTION: The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established at each Federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office may elect to combine the Office within the existing organization.

(a) Please provide the subcommittee with a list of Federal laboratories owned and funded by your agency (whether or not operated by your agency).

(b) For each laboratory on the list described in (a) please give

(i) the total annual budget for FY 1981

(ii) the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applications. If the ORTA is combined with an existing organizational structure, name the structure.

ANSWER: As stated in NSF's testimony, the Foundation does not have federal laboratories in the usual sense of the term, that is laboratories funded and managed by a federal agency where "in-house" research related to that agency's mission is performed by federally-employed scientists and engineers. The Foundation does own and provide operational support for five national centers for research in astronomy and one national center for research in the atmospheric sciences, all of which are managed by non-profit organizations under contract to NSF. These centers are staffed by non-federal employees and are available to visiting scientists. They do, however, fall within the definition of "Federal laboratory" contained in P.L. 96-480, Sec. 4 (7).

The centers are listed below. For each center its budget for FY 1981 and the name and organizational affiliation of the staff person responsible for the ORTA functions are provided.

Cerro Tololo Inter-American Observatory $5,561,000

Mr. James B. Way, Jr.
Director
Office of Administrative Services
Cerro Tololo Inter-American Observatory
Casilla 603
La Serena, Chile

Kitt Peak National Observatory $10,712,000

Mr. James F. Kattinge
Director
Office of Administrative Services
Kitt Peak National Observatory
Room 120
Post Office Box 26732
Tucson, Arizona 85726
602/325-9366

National Astronomy and Ionosphere Center	$5,224,000

Mr. Eugene F. Bartell
Administrative Director
National Astronomy and Ionosphere Center
Space Sciences Building, Room 406
Cornell University
Ithaca, New York 14853
607/256-3734

National Radio Astronomy Observatory	$14,258,000

Dr. Robert J. Havlen
Assistant to the Director
National Radio Astronomy Observatory
Room 317
Edgemont Road
Charlottesville, Virginia 22901
804/296-0223

Sacramento Peak Observatory	$1,794,000

Mr. Frank A. Hegwer
Administrator
Sacramento Peak Observatory
Sunspot, New Mexico 88349

National Center of Atmospheric Research	$28,850,000

Mr. Harold W. Bayton
Deputy Director
Atmospheric Research
P.O. Box 3000
Boulder, Colorado 80307
303/494-5151 ext. 393

2. QUESTION: (a) What is your agency's total research and development budget for FY 1982 expected to be?

(b) What is your agency's total budget for the technology transfer function, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982?

Please provide a breakdown of the technology transfer budget (as described in (b) above) into whatever detail is used to calculate it.

ANSWER: (a) The Foundation's FY 1982 Budget Request for Research and Related Activities (excluding funds for Program Development and Management) totals $956.9 million. These funds would support research in the various sciences and engineering, the large-scale ocean drilling and polar programs, policy-related and statistical studies and data collection, and certain international science efforts. Congressional action on the request is not yet complete. NSF does not have statutory authority to support development activities.

(b) It is not entirely clear to us precisely how to interpret the term "technology transfer" as defined in PL 96-480 and H. Rept. 96-1199. The Foundation supports basic and applied research in all fields of science and engineering, most of which is conducted by individual investigators in academic settings. As noted above, NSF does not support development activities. Hence, generally speaking, it does not "own" or "originate" technology that may be transferred to State and local governments or the private sector. (See p. 32 of H. Rept. 96-1199, which indicates that furtherance of such transfer is the goal of Sec. 11 of PL 96-480.)

NSF-supported projects may, however, result in"processes, products and services that can be applied to state and local government and private sectors needs" - the broad definition of "technology transfer" used in H. Rept. 96-1199 (p.32). An example would be the recent spawning of new industries using recombinant DNA techniques resulting from scientific breakthroughs in molecular biology.

The House Report, however, goes on to propose that only activities concerned with the transformation process itself and only those "dedicated to technology transfer from the outset" should be so classified (p. 32). In terms of this narrower definition, the Foundation is engaged in a variety of activities that in our judgement are concerned with the transformation process itself and were so intended from the outset. These activities are designed to strengthen the links between producers and users of research and thus provide conditions under which technology transfer can take place. Such activities would also seem to be directly in keeping with what H. Rept. 96-1199 calls (p. 3) the "overarching thrusts of the bill", namely, "(1) to build links between generators of knowledge (universities and Federal laboratories) and users of knowledge (industry and State and local governments); and (2) to build into the Federal Government a positive concern for the welfare of industry."

The NSF budget request for FY 1982 allocates approximately $10 million to programs of this nature, which is more than one percent of the proposed budget for Research and Related activities.

(c) Using the definition spelled out above, the budget request for FY 1982 contains funds for the following activities related to technology transfer:

University-Industry Cooperative Research Centers	$1,700,000
Industry-University Cooperative Research Projects	950,000
Innovation Process Research	1,000,000
Small Business Innovation Research Projects	5,000,000
Technology Innovation Projects	900,000
Engineering Communications Program	400,000
Offices of Research and Technology Applications	(100,000)*
Federal Laboratory Consortium for Technology Transfer	(50,000)*
	$9,950,000

(* Estimates of overhead support costs, not included in total.)

Questions submitted by Mr. Watkins

1. QUESTION: Judging from your statement, it appears you have misjudged what Congress intended when it mandated technology transfer in Section 11. Technology transfer was defined, for purposes of the Act, as the four functions listed in Section 11 (c). These functions are:

   1) Preparation of application assessments for R & D projects.

   2) Provide and disseminate information.

   3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community.

   4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

   I think it is important to stress that "information dissemination" comprises only ¼ of our definition of tech transfer. Please provide for the record a breakdown of all the tech transfer functions you cited as satisfying the .5 percent funding set-aside and indicate into which of the four classifications each falls.

   ANSWER: As indicated in Dr. Slaughter's statement and in the above responses, there is no development, and hence little if any "useful technologies" (see p. 35 of H. Rept. 96-1199) resulting at the national centers for astronomy and atmospheric sciences from the programs conducted there. Hence few if any of these projects are relevant to the Functions of the Research and Technology Applications Offices spelled out in Sec. 11 (c).

   In terms of broader definitions of technology transfer contained in H. Rept. 96-1199, however, the Foundation has, over the years, developed programs with the goal of facilitating the application of knowledge gained in research to both the public and private sectors. Because technology transfer is a complex process, the problem has been attacked with a variety of different approaches, ranging from dissemination of knowledge of already completed research to means of linking university, industrial, and governmental sectors, and including study of the transfer process itself. In addition, the Foundation plays a fundamental role in strengthening the science and engineering base that is necessary if technology transfer is to take place.

   Our response to Committee question #2 provides a list of Foundation activities serving these more general purposes. They include work in several if not all of the four functional classifications listed in Section 11 of the Act, but it is not possible to provide a breakdown of funds in these precise terms.

2. QUESTION: On Page Two of your statement, you mention that much of the technology which finds its way into the public and private sector through NSF programs did not start out as direct tech transfer activities. Yet you appear to take credit for these "success stories" as part of your mandated tech transfer responsibilities under Stevenson-Wydler.

This Committee's report which accompanied the Act makes it very clear that this does not satisfy the tech transfer requirements of the Act. Let me quote from Page 32 of the Report:

> "...(T)he overriding consideration in making a determination as to what should be categorized as technology transfer is that the activity so classified should be dedicated to technology transfer from the outset (emphasis added)."

Based on that definition, Dr. Slaughter, how much of the tech transfer activities that you've taken credit for this morning could be applied toward the .5% set-aside required in the Act?

ANSWER: As previously indicated, there are a number of Foundation activities concerned with strengthening the links between producers and users of research - projects so concerned from the outset. While they may not fall within the definition of "technology transfer" intended by the Committee, our reading of H. Rept. 96-1199 suggests that they are consistent with various definitions of the term contained in the Report. We believe these programs, a brief description of which follows, meet the requirements of Sec. 11 of the Act in terms of the organizational characteristics and R & D activities of this agency.

University-Industry Cooperative Research Centers are NSF-pioneered technology centers of the type envisioned in P.L. 96-480. Each center represents an experiment that is structured by university-based scientists to attract industrial support for its research activities and to stimulate technology transfer. Centers established by NSF have dealt, for example, with welding technology and polymers.

Innovation Process Research conducts both intramural and extramural research aimed at improving understanding of the process through which technological innovation and technology transfer occur and how they are affected by Federal policies and practices. In addition to studying such topics as the role of small business in the innovation process, the program examines the effect of NSF programs concerned with technology transfer and implementation.

Small Business Innovation Research supports advanced, high risk research with small business firms. As noted in the FY 1981 Program Solicitation, an important goal of the program is "the conversion of NSF-supported research into technological innovation by private firms for its socioeconomic benefits to the Nation."

Technology Innovation Projects tests specialized innovative efforts combining university and industry interactions to accelerate the adoption of high-risk NSF produced research results into practical applications by demonstrating feasibility.

The Communications Program provides and disseminates information on NSF projects to the interested public.

Industry/University Cooperative Research Projects encourage technology transfer through the vehicle of cooperative research projects carried out by scientists from universities and industries. At least 10% of the FY 1982 request of $9.5 million is devoted to the collaborative arrangements that foster technology transfer within the restricted definition that has been used in section 11.

The Intergovernmental Programs, having the objectives of integrating scientific and technical resources into state and local governments, was phased out as a demonstration and direct support activity in the FY 1982 budget request.

3. QUESTION: Dr. Slaughter, what is NSF doing now to promote tech transfer that it wasn't doing prior to enactment of the Stevenson-Wydier Innovation Act:

   ANSWER: The Foundation created and implemented programs to encourage technological innovation prior to the passage of the Stevenson-Wydler Act. For example, the Industry/University Cooperative Research Centers, a program established in FY 1973, correspond to the Centers for Industrial Technology recommended in PL 96-480 and, in fact, served as a model for the proposed CIT's. In addition to the efforts supported by this program and the others listed above, the Foundation has taken the following actions:

   - The establishment of Offices of Research and Technology Applications in each of the six NSF-funded Astronomy Centers.
   - The assignment of a Technology Transfer Officer at the National Center for Atmospheric Research, the one NSF-funded laboratory having an annual budget exceeding $20 million.
   - The appointment of a Project Analyst for Communications whose responsibility is the dissemination of information on projects supported by the Foundation's Engineering Directorate.

4. QUESTION: Let's examine the reverse of the last question. What is NSF not doing now that it was doing prior to enactment of P.L. 96-480? Specifically, haven't you requested zero funding for the National Innovation Network, the SSET program, and program support funds for the Federal Laboratory Consortium in FY 1982?

   ANSWER: In compliance with the President's effort to reduce Federal expenditures, the NSF Budget proposed for FY 1982 does not request funds for a number of programs that are not central to the Foundation's basic mission of supporting high-quality scientific and engineering research. Among these programs are several that are relevant to the purposes of P.L. 96-480, including the following:

   University-Based Innovation Centers
   Science Faculty Professional Development Program
   Intergovernmental Programs

   The last of these includes the National Innovation Network, State Science, Engineering and Technology, and Federal Laboratory Consortium programs, all of which were supported by Intergovernmental Program funds. However, the Foundation will continue to provide a base and overhead support for the Federal Laboratory Consortium program managers, though we will no longer support program activities.

   We will continue in FY 1982 and subsequent years to seek to implement the purposes of P.L. 96-480 in ways that are consistent with the Foundation's limited role and resources.

Mr. WALGREN. The next witness is Mr. Harold Jacobson, the mayor of Carson City, Nev.

Gentlemen, welcome to the committee. We appreciate your being able to be with us and we particularly look forward to your views of this area and what you feel we can do constructively to be of help to your constituents.

TESTIMONY OF HON. HAROLD JACOBSON, MAYOR OF CARSON CITY, NEV., ACCOMPANIED BY THEODORE J. MAHER, PROGRAM DIRECTOR, COOPERATIVE EXTENSION SERVICE, U.S. DEPARTMENT OF AGRICULTURE; AND DAVE GATTON, U.S. CONFERENCE OF MAYORS.

Mayor JACOBSON. Thank you very much, Mr. Walgren. I appreciate your invitation. One of the things that I took good note of was that you'd like to have a two-way conversation, and I believe that is the best way to testify at a meeting such as this one.

I have with me a couple of gentlemen that I've asked to be here in case I make a mistake or can refer it to them because of their background and experience.

On my right I'll introduce Dave Gatton who is with the U.S. Conference of Mayors, and on my left, Ted Maher, who was the first executive secretary of—I think that's his title—CTIP and who has now moved over to the Department of Agriculture. But he's been very close to this for a long, long time and I am sure that he can answer some of the questions that I can't.

I come from a long way, and I do appreciate Mr. Brown being up there this morning because when you come from Carson City, Nev., when you're there southern California seems like a long way away. But when you're this far on the other side of the Nation it seems like it's right next door. And I am glad you are here. I do appreciate the fact that you have attended some our meetings and paid close attention to what we are doing.

When you are far away, like I am, and there are no Federal laboratories right next door, and you know that there is a lot of information around that you can't get your hands on, you do appreciate the opportunity to work in an organization such as CTIP.

I have been involved with it from almost its very beginning. I've served as a member of the steering committee and am presently the chairman nationally of that organization.

We are attempting through 32 small communities strategically located throughout the United States to represent some 30,000 communities. And that's a pretty tough job. The communities are on the four corners of this country and a lot of areas in between; so they are pretty representative kind of communities.

But we need to have a better way of getting information out.

This is my fourth trip to Washington this year, which is probably as many as I made altogether before this year since I've been in this office, and the reason I cam here is because the administration recommended that our intergovernmental science distribution be eliminated. It seems to me like that would be the wrong way to do it. It reminds me very much, because I am an agricultural graduate and I was involved with universities for many years, that it would be like having the agricultural experiment stations without having an extension service. It doesn't seem correct to me to have the billions of dollars being spent annually plus all of the ones we spent in the past to find out what the good answers are and to make them available only to the Federal Government and to the Armed Forces and so forth. That information is there. It can be used by local governments. And if this Section 11 is passed, as I understand it, it's going to provide that there will be some dollars spent in that direction.

You just don't manufacture a great product and then not do anything with it. I look at the National Science Foundation and the labs as an area where we are trying to find out what's going on. When we find those things out I think all of the American people ought to have something to do with it and be able to get it.

I was particularly interested in the fact that it said it would also make it available to private industry because we are attempting to phase out the Federal participation in public technology and in the transfer, and the way to do that is to get it from the private sector. But if the private sector doesn't understand and can't get the information, then they're not going to go along with that.

So I particularly like that part of the bill.

We need to receive information out there far away, as I come from, in these small communities from someone besides the salesman. Now, that's my profession. I'm a salesman. I respect what they do. But I think that we ought to know that there are other products; there are other competitive products; and that there have been some scientific and technological information developed and we ought to know which direction we ought to go in before we spend many, many dollars.

I was involved one time in the spending of about $1,200,000 in acquiring a new computer system for the University of Nevada, because I served in that capacity as chairman of the board one time. I found out 3 years later we had made a mistake; that we had listened to the wrong people. And we had to go back. And at that time we brought in our own people and did check it out.

These are the kind of things that I believe CTIP, which is my organization, can do.

Last year and the year before when we in Carson City went on the computer system, we did ask CTIP to help us. And we did get some background and some information we found out from some other areas. And instead of spending like $30,000, $40,000, or $50,000 to find out what was best we asked CTIP and they found another community that was doing the same thing and we got the information almost for free. You can't do that unless you have technical people.

So we're very much concerned it looks like we're going to our tech agents, because at least they could talk to the laboratories.

Now that we're going to be able to keep them—by some of the legislation that's just recently been passed it's been mandated that that's going to happen—we're pleased that we know the information will be there and can be received.

It seems to me like section 11 is going to make it so that every laboratory will have someone there that you can contact. Either us or people from far away.

I've got some more things that I can say, but I would rather go along with what you've suggested, Mr. Walgren, and have a two-way conversation.

[The biographical sketch and prepared statement of Major Jacobson follow:]

Mr. Chairman, I am Harold Jacobson, Mayor of Carson City, Nevada. I am now national chairman of the Community Technology Initiatives Program (CTIP) and have served as a member of its Steering Committee since its inception. I am also a member of the Steering Committee on Energy and Environment of the National League of Cities and I am serving on a similar committee for the U.S. Conference of Mayors.

Carson City has a consolidated city-county government serving a population of 32,000. It is the Capitol of the State of Nevada which has just over 800,000 residents. In addition to being the seat of State Government, Carson City relies on tourism, light manufacturing, retail businesses, and professional services for a total area of 80,000 residents.

I have served 12 years as a member of the Board of Regents of the University System and was chairman of the Board for 4 years.

I have served as an Assemblyman in the Nevada Legislature 1946-48 and continue to work closely with the legislature.

Responses to Section 11 of Stevenson-Wydler

I. Policy has been established that the Federal government should transfer its developed technology to state and local governments.

Reaction - This is encouraging to those state and local government officials who recognize the wealth of knowledge warehoused in the nation's research laboratories that have potential utility in and benefits to their communities. Billions of our tax dollars are spent in conducting federal research and development. In 1980, it was reported that national R&D spending was expected to exceed 57 billion dollars. Even though these dollars are expended in addressing national priorities, in many cases, the R&D results have applications at the State and local levels. The R&D results shared with state and local governments can be viewed as additional returns on the public's investment.

II. Establishes an Office of Research and Technology Applications in Federal Laboratories.

Reaction - (1) Local governments participating in the Community Technology Initiatives Program (CTIP) are aware of the benefits of establishing such offices. We have had access to some of the resources of the Federal laboratories through this program. CTIP, a network of 32 small local governments involved in technology transfer, links Federal labs/agencies and local governments through the use of circuit riding technology agents. These agents are scientists and engineers on assignment from Federal laboratories and CTIP localities via Intergovernmental Personnel Act agreement. (2) Through the CTIP relationship local governments have readily obtained technical information and support from R&D centers and laboratories, and assistance in assessing their technical needs and problems, and potential solutions; and have hands-on experience in adopting related lab derived technologies. (3) Using Federal lab expertise and information, local governments in CTIP collectively have saved over $2,638,559 to date. Among these money savings are: emergency calls from citizens recorded automatically through city computers at a savings; TA software development which enabled a local government to use computers to process financial and other data, at a savings; use of paneling with extreme heat resistance capacity which prevents the disintegration of burn towers used in training firefighters; and improving the efficiency of water pumping technology to cut energy consumption. (4) These offices should enhance state and local government access to their R&D results and information. Not until CTIP jurisdictions began to interface with Federal labs did they discover the valuable information and product developments that relate to their needs which includes items such as: Antifog - material for firefighters goggles developed by NASA; Piston Film solution developed at the Naval Research Lab to contain small oil spills over water, however, it also has properties that control mosquistos; standardized specifications for firefighters equipment adopted by the Army; easy to use and efficient rust removal and protection solution developed by the Navy; decal removing solution developed by the Navy can be applied in many urban communities.

There are numerous examples of applicable state/local government and lab technology matches. Establishing these offices would facilitate linking local government needs and problems with applicable lab resources. Hopefully, the lab responses would be accelerated, especially if the labs have assessed their R&D for state and local government applicability.

III. Create a Center for the Utilization of Federal Technology

Reaction - (1) Creating this center would benefit state and local governments by providing an easy point of entry to this vast system of Federally derived technologies and information, and allow the Federal government to respond to inquiries in a timely manner. This simplifies the information system, making less intimidating to the potential users. (2) Coordination among the Federal agencies and labs is essential. Again, it is necessary to insure quick and effective responses to user (state and local) inquiries. (3) Most important is providing funding for adopting the information or technology. Our CTIP experience has shown the physical presence and assistance of a federal lab personnel greatly enhances the transfer of any technology to the local government. Adopting the technology or information for state and local government utilization, often requires the expertise of lab personnel. State and local officials and managers are involved in meeting the day-to-day responsibilities of serving the public. The time and skill level required to modify technical products and information is not commonly available, especially in small localities.

IV. In general if Section 11 were implemented fully, it would greatly enhance the capacity of state and local government meet the complex challenges in providing public service to communities of the 80's and beyond.

Mr. WALGREN. Well, we appreciate that very much.

Let me first recognize Mr. Brown and we'll go from there.

Mr. BROWN. Well, I want to thank Mr. Jacobson for being here. I recognize that we are a long ways from home here, but we get used to that after a while I guess.

It's particularly important, I think, to have your testimony on the value of the CTIP program and the emphasis which it has placed on the direct interaction between the local governments and the Federal laboratories. I wonder if you could describe that program in just a little bit more detail so that the record would indicate something about the nature of the small communities and where they are located and so on.

Mayor JACOBSON. Perhaps Mr. Maher could answer that better than I can because he was in on the days when these communities were selected. So if you would, Ted.

Mr. MAHER. Yes, I would be pleased to talk about the structure of the program.

It basically includes 32 communities from 32 different States across the country. All of these communities are under 50,000 in population. A number of them are counties, townships, cities. They represent a cross section of near forms of government, city manager forms, administrators, and the population is on average, I would say, of about 25,000, although they range as low as 8 or 9,000 in population.

Basically these communities were chosen in consultation with the public interest groups here and across the country and they were chosen on the basis of their record for innovation and interest in science and technology applications to local government problems.

Since we're dealing with a population under 50,000, there are thousands, as you know, of these communities across the country. So what was attempted was to try select a community in each of the States which was regarded as a leader and an innovator.

In a sense this program predates the legislation in the sense that it was one of the earliest efforts to try to link Federal laboratory expertise with local government problems through the use of a technology agent, a circuit rider on site, who would either be a senior scientist or engineer charged with doing basically two things. One was to provide problem-solving support to the local government officials in a kind of a hot-pursuit basis; that is, those problems that come up on a day-to-day basis could be referred to these technology agents.

The second role of the individual was to try to serve as a broker, a link between the problems that were addressed at the local level and the laboratory technology that might exist either in the individual's own lab or in the network across the country.

So basically the purpose was to establish that network of communications with these communities, and once solutions were uncovered, then to try to broadcast those solutions and experiences as widely as possible across the rest of the State based on that individual experience.

Mr. BROWN. Well, I've had a general familiarity with the program for some time. It was precisely this kind of program that entered into the thinking of the authors of the Stevenson-Wydler Act as being a very important initiative that ought to be continued on a firm basis.

Mr. Jacobson has submitted some material that indicates that there have been several millions of dollars in savings to date based upon this program. Is that based on an analysis of that is made periodically of the progress of the program? How is that figure arrived at, specifically?

Mayor JACOBSON. That's how it was made. It was an analysis of what we've done. How can you measure exactly what kind of benefits come from this kind of a program? The information is there and maybe we've already used it, but there's a good chance that someday we will use some of the things we know about now.

Mr. BROWN. If the programs include some sort of a periodic analysis to determine to what degree the benefits can be quantified.

Mayor JACOBSON. That's correct. But it's still pretty difficult to say exactly what's happened because there is more than we can document.

Mr. BROWN. It's no more difficult than trying to get a cost-benefit analysis on a Corps of Engineers project. [Laughter.]

Mayor JACOBSON. Maybe not quite that difficult.

Mr. BROWN. You've also stressed the importance of the personal contact through the circuit rider type person or other professional who can bridge the gap between the laboratory resources and the needs of the community. Could you indicate a little bit more about that, though? How many man-years are being devoted to this kind of personal interaction, roughly speaking? And how much does each particular city get in terms of this kind of manpower?

Mayor **Jacobson**. I don't know the answer to how much manpower is involved, but there were about eight of these tech agents that were partially financed by the labs which they were connected with and some of the communities did spend some of their own dollars in making sure that they had funding to travel back and forth and that sort of thing.

I would say, however, to answer the first part of your question, specifically scientists are kind of a different sort of person from the rest of the community that's out there in the field working. And I say this with all respect to scientists and to professors, because without them I wouldn't be where I am today. It took a long time for me to recognize all of the things and why I had to learn all of the things I had to in college and why I have a degree and all of the other designations that I've received since that time. I know that without the background that I got there I would be in real serious trouble. On the other hand, if they were to try to do my job they would probably encounter the same kinds of trouble as I find in being one of them.

So we need someone that can talk their language, that can make the correct approaches and can go to the right places to find out the information and then to convert that back to something that we as administrators and politicians can interpret correctly.

Mr. **Brown**. That's a key point in this whole legislation, the need for this kind of a bridge between the producer and the user of information, and you've made the point very well.

I think we're going to have a little recess here, probably.

Mr. **Walgren**. Yes, we have to respond to this rollcall, so we will suspend for 15 minutes, perhaps less. I should probably say 10 minutes.

Mayor **Jacobson**. We get a recess, too, then?

Mr. **Walgren**. Yes, sure. [Recess.]

Mr. **Brown**. I expect the chairman to return momentarily. He has apparently been delayed on the floor, and in the interest of completing our witness list this morning I think we'll proceed. I will ask Mr. Jacobson if he would care to add any additional point to his testimony or summarize his own position with regard to the technology tranfer function, and more specifically the CTIP program with which he's had a favorable personal relationship since his role in local government.

Mr. Jacobson?

Mayor **Jacobson**. Thank you again, Congressman Brown.

I did want to touch on one of the things that I believe Dr. Slaughter or one of his assistants up here mentioned a while ago about the question from Chairman Walgren, the question about the $1,200,000 that were being spent for studies. I've only participated in one such study. I believe the name of the organization was Alexander. At least that's part of it. And we had a meeting in Los Angeles and stayed at the Bonaventure. I would say it was a very fine meeting. We had a lot of nice things there, a beautiful room to stay in, good meals. But I don't think that very much was accomplished, because it was information that we already had, except that what amazed me is we would have it in downtown Los Angeles and none of the people who were invited to the meeting came from Los Angeles.

I think there is a lot of waste in studies. And I would like to add that as part of my statement in this record. I think that we need to get the information that's already there out to those of us who can use it.

This year at the U.S. Conference of Mayors in Louisville, which was not too long ago, the conference adopted unanimously a resolution endorsing section 11 of the Stevenson-Wydler Act. And there wasn't any question about it. We felt that that information had to be distributed and that this was a good thing.

We have some plans and some policies set up in the U.S. Conference of Mayors, and I've asked Dave Gatton to make those available to this committee. So you'll be receiving those in the next several days.

Mr. Brown. We look forward to receiving them.

Mayor Jacobson. To summarize what I've been trying to say and what we hope you will take very seriously, we believe that the administration and Congress has recognized a desire of the taxpayer to cut Government expenses. And that has been handed on down to the States and it's been carried clear down to the grassroots kind of government which I represent. But in our particular case, and I've searched in other areas around the United States, we have been limited in our income and there's been a cap put on spending. And this is a time when being able to use some new technology, some new ideas to find the veritable better mousetrap—it's right now. Today is the time when we need to know about those things.

It makes little sense to me to spend billions to acquire new knowledge, new technology and then to put it on the shelf and hope that someone will be able to find that information and put it to practical use.

Section 11 seems to recognize a real partnership can be made between local government, State government and the Federal laboratories. The information is there for the military to use and for some of the Federal agencies to use, and we believe that some of that can also be used. I think a good example of what can be done, and I'm not endorsing them as being completely correct, is the way that the agricultural experiment stations work with the extension service. One of them searches out the information and the other one disseminates it. And we have been able to feed not only America but a good portion of the world because of the fact that we know how to produce things better and we are out there and the information is available.

If you could do the same thing for the cities and counties around the country it would be extremely important to them.

There are 30,000 small cities and counties, and they desperately need to know what new technology is around. They want to know how to apply it, how to get it for their use. Section 11 seems to be the step in the right direction. And I would wholeheartedly endorse it, and I know that I speak for most of the small communities in this great country of ours.

Thank you very much for giving me the opportunity.

Mr. Brown. Well, thank you, Mr. Jacobson, for this extremely helpful input representing the experience and the views of the smaller communities of this country. I'm sure you have recognized from listening to comments from members of the committee that we are deeply concerned that the benefits of this federally generated knowledge base be broadly available across the country, to all units of government and to all segments of the population. We feel that this is owed to the taxpayers of this country and that we need the best possible mechanisms for achieving and you've provided some very useful enlightenment as to the success of the existing programs and the need for additional effort to be put into those programs in order to achieve these goals.

Mayor **Jacobson**. If there are any other questions, I will be glad to respond.

Mr. **Brown**. I appreciate that, but in view of the time I think we'll excuse you at this time, Mr. Jacobson. If we need to submit additional questions to you, with your cooperation, we'd like to do that in writing in order to complete the record.

Mayor **Jacobson**. Again, thank you very much.

Mr. **Brown**. Our next witness this morning is Dr. Narinder Kapany, who is director of the innovation center at the University of California at Santa Cruz.

We welcome you, Dr. Kapany, and regret any delay that our schedule may have caused you. I notice you've been a faithful attender of yesterday's session as well as today's. You're a hard man not to notice. [Laughter.]

Dr. **Kapany**. Well, I was trying to be inconspicuous, Mr. Brown. Obviously I didn't get away with that.

Dr. **Brown**. We welcome you particularly because you come immediately at least from my own State of California and the great University of California system. I'm glad to have some contributions from California and it's great university to the thrust of this hearing, and having read your testimony, I am aware of the importance of what you have to say in connection with the thrust of the Stevenson-Wydler Act. We welcome you.

[The biographical sketch of Narinder Kapany follows:]

NARINDER KAPANY

Narinder Kapany originally proposed CIED and has been its Director since its inception.

Kapany has distinguished himself in physics, is one of the founders of the field of fiber optics, and has been the developer of a substantial number of technologically and socially important electrooptic applications, including the widely used laser treatment for the detached retina and fiber optics endoscopes.

A number of successful, high-technology companies have been founded by Kapany, and he continues to operate Kaptron, Inc., a company developing advanced devices for the fiber optics communications field. He currently serves as a director or consultant for a number of small and large corporations and government agencies.

Kapany has also been entrepreneurially active in real estate and agriculture.

Kapany has been a member of the National Inventors Council and has been honored by a number of academic appointments including Regents Professor at the University of California.

A detailed curriculum vita appears on the following pages.

NARINDER KAPANY

Curriculum Vita

EDUCATION	Ph.D., Imperial College of Science and Technology, University of London, in Technical Optics (1954)
	Diploma of the Imperial College (D.I.C.) Imperial College of Science and Technology, University of London, in Technical Optics (1952)
	B.Sc., Agra University, Physics and Mathematics (1948)
ACADEMIC POSITIONS	Director, Center for Innovation and Entrepreneurial Development (CIED), UC Santa Cruz, 1979-present
	Regent's Professor, UC Santa Cruz, 1977-78
	Visiting Scholar, Physics Department, Stanford University
	Research Associate, Institute of Optics, University of Rochester, New York, 1955-57.
EXECUTIVE POSITIONS	President, Kaptron, Inc., Palo Alto, presently
	Chairman of the Board, President and Director of Research, Optics Technology Inc., Palo Alto, 1961-73
	Director, Asia Development Corporation (technology transfer company), Oakland, 1971-73
	Director, Societe Belge D'Optique, Gent, Belgium, 1963-69
	Director, Export Marketing and Management Services, Inc., Palo Alto, 1968-71.
	President and Director, Medoptics, Inc., Palo Alto, 1968-71.
	Manager, Optics Division, IIT Research Institute (formerly Armour Research Foundation), Illinois Institute of Technology, Chicago, Ill., 1957-61.
	Manager, Ordnance Factory, Dehra Dun, India, 1949-51.
	Director, The Southwall Company, Inc., 1980-present
	Member, National Inventors Council, 1962-73.

Narinder Kapany Curriculum Vita

TECHNICAL ACHIEVEMENTS

Over 70 patents including 50 issued and pending in the field of optics, among which are:

1. Dynamic scanning of images through fiber optics.
2. High speed photography systems.
3. Techniques for fabricating fiber optics devices.
4. 3-Dimensional optar.
5. Laser retinal photocoagulation.
6. High efficiency solar collectors.
7. Pollution monitoring device.

Conceived and developed numerous products applying electrooptics technology (lasers, fiber optics, thin films, photoelectronics, etc.) to the fields of medicine, night vision, M.T.F., metrology and photography, e.g.,

1. Fiber optics endoscope.
2. In Vivo Oximeter.
3. M.T.F. Analyzer.
4. Laser (ruby and argon) retinal photocoagulator.
5. Holographic instrumentation.
6. Solar system for heating and cooling buildings.
7. Digital readout spectrophotometric device.

PUBLICATIONS

Fiber Optics: Principles and Applications, Academic Press, New York, 1967.

Optical Waveguides, Academic Press, New York, 1972.

Approximately 80 publications in the fields of fiber optics, lasers, thin films, and optical information processing, including:

A series of 14 articles entitled "Fiber optics," *Journal of the Optical Society of America*.

Cover article, "Fiber optics," Scientific American November 1960.

"The laser: A new tool for photocoagulation," Proceedings: Conference on New and Controversial Aspects of Retinal Detachment.

"Fiber optics and the laser," Annals of the New York Academy of Sciences, May 28, 1965.

"Laser retinal photocoagulation," Applied Optics, May, 1965.

"Inventor-Entrepreneurship and National Priorities," National Bureau of Standards Special Publication 388, May 1974.

Innovation, Entrepreneurship and the University, National Science Foundation, 1979.

TESTIMONY OF NARINDER S. KAPANY, DIRECTOR, INNOVATION CENTER, UNIVERSITY OF CALIFORNIA AT SANTA CRUZ

Mr. KAPANY. Mr. Chairman, I wish to thank you and your committee for the invitation to present my views in these hearings. I am pleased to share with you today what I believe to be an important and in fact unique approach to improved productivity in the United States. What I would like to say is simply summarized: America's faltering positions in technological innovation, entrepreneurship, and productivity can in no small measure be addressed by a well-conceived program directed at college students. The essence of this program is the training of these students in the fundamentals of innovation and entrepreneurship and involving them in its implementation. In this regard, our college youth warrant particular attention, for the following reasons:

First, their contributions can be large, and on a time scale as short as that for any other approach;

Second, by creating an environment of interaction with the business and industrial communities, they will be motivated toward innovative and entrepreneurial careers;

Third, our program at University of California at Santa Cruz, which has involved students from a wide range of disciplines, has attracted national and international attention and requests for assistance in emulating our center. The soil is exceedingly fertile;

Fourth, if boldy conceived and effectively managed, even a modest government program would have large impact; and

Fifth, It takes only awareness and a small amount of attention to attract minorities and women college students to these activities.

I must now elaborate on these statements and explain my confidence. Since my background in technology and business plays an important role in my thinking, with you permission, I would like to describe that first.

As is perhaps evident, I am a Sikh. I was born in Punjab, India. After my graduation in India I went for postgraduate studies at the

Imperial College of Science and Technology in London. My Ph. D. thesis was one of the original publications in the field of fiber optics—which has resulted in significant developments in medical instruments for viewing internal organs in the body, and is now expanding into the field of fiber optics communications.

I came to the United States with my wife in 1955 to do research at the University of Rochester, Rochester, N.Y. It was in the year 1960 that I started my own company to develop modern optics technology and products. We worked in the fields of lasers, fiber optics, optical thin films, and so forth. In the early 1960's I was involved in the development of the laser for retinal detachment, night vision device components, fiber optics devices, and optical thin films. While running this company I was involved in acquiring six other companies in the United States and Europe, and also took my company public.

In the 1970's I became actively involved in agriculture, real estate, and a number of new start-up companies. Currently, along with my activities at the university, I have a corporation, Kaptron, Inc., which is developing products in the fields of fiber optics communications and laser arthroscopy. Additionally, I am actively involved in Sikh cultural affairs.

Our technologically innovative society and free enterprise system has been very good to me. I am eager to help its reinvigoration.

In 1979 I was invited to spend an academic quarter at the University of California at Santa Cruz as "Regents Professor." I became so impressed with the potential for helping college students develop careers, that I continued my association with the university. While considering how best to use my background and contacts in the business and industrial community, I became aware of the National Science Foundation's innovation center program. I am sure you have been told of at least some of their successes. I have seen them first-hand. The program is clearly an effective and important activity. At this point I would like to sympathetically mention some of the problems and limitations of their present innovation center program.

First of all, these innovation centers were expected to become self-supporting within 5 years from income derived from companies they spawned. This is an unrealistic time scale. Unfortunately, such quantitative measures of success loom large, and the harder-to-assess, but actually more important effects on people tend to get overlooked.

Second, the success of the present innovation center program is often difficult to distinguish from what might otherwise be expected from the business and engineering schools to which the NSF innovation centers have been limited. Because of this limitation, each of the present innovation centers has significant university expertise in business and technology to draw upon. But that coin has another side. Because of the considerable academic expertise on campus, they do not experience the pressure to develop a fruitful interaction between the university students and the business/industrial community.

Unfortunately, we now see redirection of innovation center funds to safer cooperative research programs. While these are almost sure to succeed, they will have modest impact, at best, on a national scale because they cannot hope to achieve the leverage of the program described here.

Could one not be a bit bolder? Our country's productivity problems are serious. With Government support, they may benefit more from a new and direct approach to the problems. A more motivation-oriented approach, more broadly addressed, with increased interaction across the walls of academe, could have a much greater impact, and with a relatively small expenditure.

We have been experimenting with a pilot version of such a program at the University of California at Santa Cruz. We have worked to develop motivations and skills for innovation and entrepreneurship in a wide range of students, not just those in business and engineering. We have engaged students in the analysis and planning of actual technical and nontechnical business ventures. This combination of tutorial and practical activity has involved the extensive participation of a substantial number of outstanding members of the business and industrial community. Some students have been inspired to establish their own companies. Some have become highly entrepreneurial and innovative employees of existing companies. It should be noted that entrepreneurial skills, while rare, are extremely useful and valued within even large established companies.

The center at Santa Cruz has developed with the enthusiastic support of the student body, administration, faculty, and local community. I believe our experience enables us to answer some critical questions:

First, is the stimulation of innovation and entrepreneurship appropriately addressed more broadly than to just that small fraction of students enrolled in business and engineering schools? Will it be effective with the larger number of other students?

Second, are the needed talents and resources available to a general campus, and where could they come from?

Third, how expensive would an effective program have to be? How expensive to the Government?

Fourth, how much impact would such a program have, and with what leverage?

First, the question about the appropriate student audience for such programs. In spite of the prominent role of engineering and business skills in modern technological enterprise, a cursory examination of the most important innovations and entrepreneurial endeavors reveals that people with science and liberal arts backgrounds have played a major role. Perhaps targeting only that 18 percent of college students enrolled in business or engineering is unnecessarily limiting. After all, exposure to technological innovation and to entrepreneurship is already present in their environments. The greatly expanded enrollment in business and engineering today is, to some extent, because students believe that these are the safe paths to the high-paying, secure jobs. Young people with perhaps unrecognized entrepreneurial inclinations might be more readily found in that 40 percent of college students majoring in the sciences or liberal arts. While most of them are headed for private sector careers, they are boldly keeping their options open. Their extensive background in scientific and/or communication abilities seems to compensate for some lack of business training.

The above hypothesis is confirmed by our experience. Students in the liberal arts and sciences are flocking to our pilot program in numbers greater than it can handle. Incidentally, minorities and women are well-represented. The students' accomplishments have been outstanding. By their own assessments and by their subsequent activities, the impact of the program at Santa Cruz has been impressive. This response is also a result of what is happening on a national scale. The shift in attitudes on the part of young people today, who now want to participate in and contribute to the system, is legitimate grounds for considerable optimism. In retrospect, that "turning off" and "dropping out" of a good fraction of our bright young people in the recent past may have been a significant contributor to our economic malaise. We missed a lot of enthusiastic young people in the business world. We would be seriously remiss if we failed to recognize the importance of the present improved trend, and neglected to take advantage of it. The answer to my first question, as to whether the stimulation of innovation and entrepreneurship should be broadly addressed to college students, is a resounding "yes."

Where will the academic resources for a center on a general campus come from?

The activities in science and economics, even applied science, seem to be more than adequate on most general campuses. I suspect that most schools also have many faculty with industrial and business backgrounds which would be useful for an innovation center. As one example of many possible, Bruce Rosenblum, the professor of physics who became associate director of our center, is the former head of the general research group of a large electronics company.

However, a most important resource comes from outside the university. The utilization of this valuable resource turns out to be a new key to substantial university/industry interaction. Because of our desire to involve students with the entrepreneurial process, we invited several outstanding members of the business community to participate in our program. We received such enthusiastic response, that we were able to be highly selective. We chose accomplished people who were also excellent communicators and experts willing to prepare extensive materials on the topics we wished developed for our students. TRW's Simon Ramo, for example, prepared a 53-page text as background for his talks. The participation by these visitors often includes considerably more than lectures and discussions. It is possible to bring real business into the classroom and the classroom into the business to provide an important experience for a broad range of students.

The secret of teaching entrepreneurship turns out to be having outstanding and perceptive entrepreneurs interacting with the students. At Santa Cruz, we are now in the process of organizing and consolidating this participation of the business community with an industrial associates program, for companies affiliated with our center. The success of the university/industry interaction component of the center has exceeded even my own optimistic expectations. I have no doubt that many campuses are in a position to tap a similar resource.

My third question was, how much would a Government program cost?

A successful center on a medium sized campus could operate effectively with an annual budget of $300,000 assuming the teaching salaries were provided as the university's contribution. Once the center was successfully operational its funding would increasingly come from other sources. Industrial organizations associated with the center will be more than willing to contribute modestly to acknowledge the advantages to them as well as the broader value of the center. A longer term source of funding will be through income from companies whose development the center has materially assisted. The need for governmental support should decline to zero over a period of about 7 years.

Each center could develop quite independently of the others, each adjusting to its own environment. Even a very small number of centers could operate effectively. If we were to start three or four centers a year, the eventual long-term cost to the Government would rise to only $4 million per year, and there would be time to evaluate the program well before even that level of expenditure was reached.

If centers for innovation and entrepreneurship are so good, why don't universities just go ahead and do it with their own funds?

There are two problems: A dollar problem and a people problem. Funding shortages today are forcing cutbacks in existing academic programs. An expenditure for something outside the university's traditional responsibility will be looked upon coolly. The people problem is at least as serious. Helping or encouraging students—especially nonbusiness students—to develop entrepreneurial skills and to have them develop working relationships involving the people and the actual operations of the business community is hardly in the university tradition.

As you know, it is hard for the universities to do the untraditional—even if the institutional leaders wish they could. Universities are not likely to initiate centers on their own. However, it is very much in the university tradition to be aware of successful projects at other institutions. A program with strong appeal to students, in this student-short era, will surmount considerable tradition-based resistance.

I now come to the most crucial question: "What impact will these centers have?"

Consider three views, expanding from the individual campus to universities in general to the national economic scene. In a typical center, approximately 200 students each year would have at least significant involvement (one course/business workshop) with a solid exposure to the business community's people and concerns. This experience usually will be much more than the students' previous contact with business and industry. Virtually all will enthusiastically report substantially influenced career goals. Approximately half of these will continue to complement their other course work with center activities in subsequent years. Perhaps, during a given academic year 300 students would have substantial involvement. The impact of this program will actually extend far beyond that. This novel undertaking will be talked about extensively on campus. Students tend to have a respect for such innovations on campus even if they are not directly involved. Centers can do a lot to develop positive attitudes toward the inovative and entrepreneurial careers our society needs. Stories about the center will appear in campus and local newspapers. Our experience shows that almost all will be exceedingly positive. When the impact on the directly involved students, the influence on those indirectly aware, and the time, energy, and money contributed by the business and industrial communities are all considered, the leverage of the investment in the center will be seen as very substantial.

In the wider frame, beyond the individual campus, the leverage of the investment is greater yet. Once the success of a few such centers is demonstrated, it will become an extremely attractive addition to almost any campus. University administrators, who are today well attuned to student interests and increasingly to those of the community, will see in these successful centers timely models for units on their own campus which warrant internal funding and expenditure of faculty energy. Our center at Santa Curz, still in its formative stages, is already being approached for help by several universities in this country and abroad, wishing to start their own. Our contact with several university presidents assures us that the desire to steer resources to such centers is widespread.

This is clearly an idea whose time is now. A small amount of Federal seed funding will produce considerable activity in fairly short order. In the largest frame of view—the national economy—the picture is necessarily in soft focus. With centers on many campuses, the attutudes and motivations of some significant fraction of the educated young people entering the producing economy will be substantially affected and that of many more will be opened positively to new possibilities.

Will this have impact on the economy?

Bright young professionals joining an organization have influence far out of proportion to their numbers and to the junior positions they initially occupy. Their drive and enthusiasm is infectious (as unfortunately, was their malaise some years ago). I hesitate to estimate the effect of a significant fraction of them feeling in various degrees that innovation is expected of them, that entrepreneurial skills are within their grasp, and that both are needed by society. I do know, however, that they are, today, fertile ground for the development of these ideas and that centers for innovation and entrepreneurial development can plant the seed.

The type of centers for innovation and entrepreneurial development I am discussing represent a significantly different approach—a more people-oriented approach. In this country we tend to shy away from such methods. Too often, perhaps, we strive for exclusively technological or abstract economic solutions to solve our socioeconomic problems. These centers addressed to young people just forming their career goals and attitudes take a more direct and human approach.

Our country's economic ills surely have several causes, and several remedies are appropriate. However, I cannot conceive of a therapy more sure to have a positive effect and one with greater leverage than that under discussion here.

Thank you again for this opportunity to present my perspective and for your kind attention.

Mr. WALGREN. Dr. Kapany, we certainly appreciate your background and the direct experience you've had with this particular program.

The Chair will recognize Mr. Shamansky.

Mr. SHAMANSKY. Thank you, Mr. Chairman.

Dr. Kapany, I was fascinated by your testimony, but the word "entrepreneurship" I find a little elusive. There was a fad some years ago about "creativity," which was pretty nebulous. Does your center offer a degree in entrepreneurship? Or do you only offer courses?

Dr. KAPANY. First of all, I should tell you that our center is just completing its second year as a pilot program. Right now we are giving a series of courses. The first of these courses is called, "Innovation and Entrepreneurship for the 1980's." The object of this course is to inspire and introduce students, all with varying backgrounds and academic majors, to the world of innovation and entrepreneurship. This course is then followed by two other courses which go into these areas in more depth.

Now with regard to your comment that the word "entrepreneurship" may be becoming a fad: I would like to say that there is no ambiguity in its definition—as is the case for the word "creativity." Furthermore, entrepreneurship is ingrained in the American heritage and system of free enterprise. We are trying to simply rekindle it and make it more pertinent to today's complex economy and society.

Let me give you an example. Our second course, called "entrepreneurship," concentrates primarily on the evaluation of an innovation, market research, financial analysis, and organization of a venture. In all of our courses, the students are divided into workshop groups. The groups are make-believe companies with an elected president, a vice president of finance, vice president of marketing, technical vice president, and vice president of manufacturing. In the second course we actually bring real innovations and real businesses into the classroom. Sometimes we work on helping businesses that seem to have potential but which are faltering.

Mr. SHAMANSKY. That are faltering?

Dr. KAPANY. That are faltering, for one reason or another. But most of them are just in the planning stage. Last quarter we had four workshops. Two of these were on companies already in existence: One called EDUCOMP, which is developing computer software for educational purposes; and another called INSPECTRON, which has a robotic device for testing the packaging of various products. The remaining two workshops involved the comprehensive planning of new companies based on two innovative product concepts. The two existing companies had been in operation for about 2 years or so, but they did not have thorough business plans. It seemed that they had good innovations—so our students went out, and did extensive market research, evaluated the innovations from not only a technical standpoint but also from a market standpoint, and then developed comprehensive business plans—approximately 150-200 page business plans—which the entrepreneurs are now taking out to try to raise money and get their companies moving.

Mr. SHAMANSKY. Dr. Kapany, how does that differ essentially from the case method as used at business schools?

Dr. KAPANY. Well, there are a number of basic differences. First of all, this is not a business school. So it is addressing a different audience, a much broader student audience. Second, this is not a case method, in which you look at the case history of a company, some years after the fact. This is actually working with entrepreneurs on new innovations and ventures.

Mr. SHAMANSKY. Well, in that sense it's a lab course.

Dr. KAPANY. It's a laboratory. It's bringing the businesses into the classroom and taking the classes into real businesses.

Mr. SHAMANSKY. Have any of your students started their own businesses?

Dr. KAPANY. Four companies have been started and, as I said, we have only just completed our second year of operation.

Mr. SHAMANSKY. Given the short time period that you've been involved, are any of the students in businesses, other people's businesses?

Dr. KAPANY. Yes they are—and that is an extremely important point. In fact, one of the statements that we often make to our students in the introductory lectures is that entrepreneurship does not only mean that you start your own company; there's a lot of entrepreneuring to be done in existing corporations. Furthermore, we emphasize that a vast majority of the students should probably never be starting a new company—only a small minority will or should do so.

Mr. SHAMANSKY. Could you operate your center effectively without Federal money?

Dr. KAPANY. Eventually, yes. In the last 2 years it has been funded by the chancellor's discretionary funds with very limited resources. There has been a lot of student enthusiasm, staff hard work, and support by the business community. However, Federal funds are essential for the first 7 years or so. Thereafter the center could become self-sufficient.

Mr. SHAMANSKY. Let me ask you this. How is this any different than saying we want to teach a person how to think?

Dr. KAPANY. well——

Mr. SHAMANSKY. Which is not bad. I'm not deprecating that. [Laughter.]

Dr. KAPANY. Well, you know, thinking is necessary in learning every subject. You have to think in physics, in chemistry, or in history. Similarly, you have to think in entrepreneurship and innovation, too. Thinking is an essential requirement for all forms of learning. But these courses are not only limited to thinking, they also include doing and practical learning. It is being involved, and rubbing your shoulders with successful role models. I will elaborate: Students that have not been exposed to business environments have an image in their heads of these successful entrepreneurs. For example, they have a certain image of a bank president, a venture investor, or president of a company. When these people are brought into the classroom and through intimate interaction, their image is reduced to human scale. We have observed a change in the students' attitudes, to one of, "If he can do it I can do it too." I think that's really one of the very important motivational factors.

Mr. **Shamansky**. Mr. Chairman, I have just one terribly important question. My terribly important question is, I was fascinated by your—is it inspectron? That's the name of it?

Dr. **Kapany**. Yes.

Mr. **Shamansky**. Have you ever heard of a company called Trontron?

Dr. **Kapany**. Trontron? No.

Mr. **Shamansky**. Well, everything ends with "tron" these days. [Laughter.]

I thought if we got a name that hasn't been used we could call it Trontron and be done with it. [Laughter.]

Thank you, Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Shamansky. Mrs. Heckler?

Mrs. **Heckler**. I would just like to pursue the issue that Mr. Shamansky raised. Would not the province of your subject matter better be placed in a business school than at the university? I find that somehow this seems to be an adjunct or supplement to business education in general. And why should there be a differentiation in the availability of courses?

Dr. **Kapany**. Well, I think that's a very good question. The role of business schools in preparing students for middle management careers in existing businesses is widely recognized. However, the country also badly needs new innovative and entrepreneurial talents to counter the problems of lagging productivity, unemployment, and poor balance of trade. I'm sure that most people here have read the recent cover page articles in Time magazine, the Wall Street Journal, and other publications emphasizing the problems of business schools. I think that the kind of activity we are talking about is a complement to what business schools or engineering schools are doing. We are trying to address an audience of liberal arts and science students that represents about 40 percent of the total students in this country. If you're going to limit these activities just to business and engineering majors, you're limiting the audience to only 18 percent.

Mrs. **Heckler**. You're talking about 200 students in one class.

Dr. **Kapany**. Well, no, I'm not just talking about that; I'm talking about students with considerably varying backgrounds. If you look at the statistics of successful entrepreneurs in this country, you'll find a significant proportion of them do not come from business schools or engineering schools. So to advocate that the only course left for a student to get into the business world is through a business school is unnecessarily limiting.

Mrs. **Heckler**. Do you offer credit for these courses?

Dr. **Kapany**. Yes; they're all credit courses.

Mrs. **Heckler**. How many hours does one require?

Dr. **Kapany**. Very good. There are 20 lectures per quarter. Each lecture is 2 hours. In addition to the classroom activity, they are expected to do homework, ranging from about 4 to 8 hours a week. Furthermore, they work in the workshops, make-believe companies, on their own time. So it's a substantial commitment of their time.

Mrs. **Heckler**. Is the homework reading homework or is it some kind of internship experience?

Dr. **Kapany**. It's both. It's both reading and working on very specific problems.

Mrs. **Heckler**. How do they find the opportunity? Does the college establish contacts with the business world?

Dr. **Kapany**. CIED has a council of directors consisting of members of the business community. Let me tell you how the center is organized. As the director of the center I report directly to the academic vice chancellor. Furthermore, we have organized a council of directors which consists of 15 individuals. Five of them come from the university, faculty and students, and 10 of them come from outside the campus. These directors are businessmen, successful entrepreneurs, presidents of their own companies, president of a bank, president of a venture capital firm. And they not only advise the center on its planning and activities but also come into the classroom, give lectures, work with the students, and then, of course, if appropriate, provide them with contacts. So we have established a wide network.

Mrs. **Heckler**. Doctor, would it be possible for you to submit a list of courses that you offer for our record?

Dr. **Kapany**. I'd be very happy to do that.

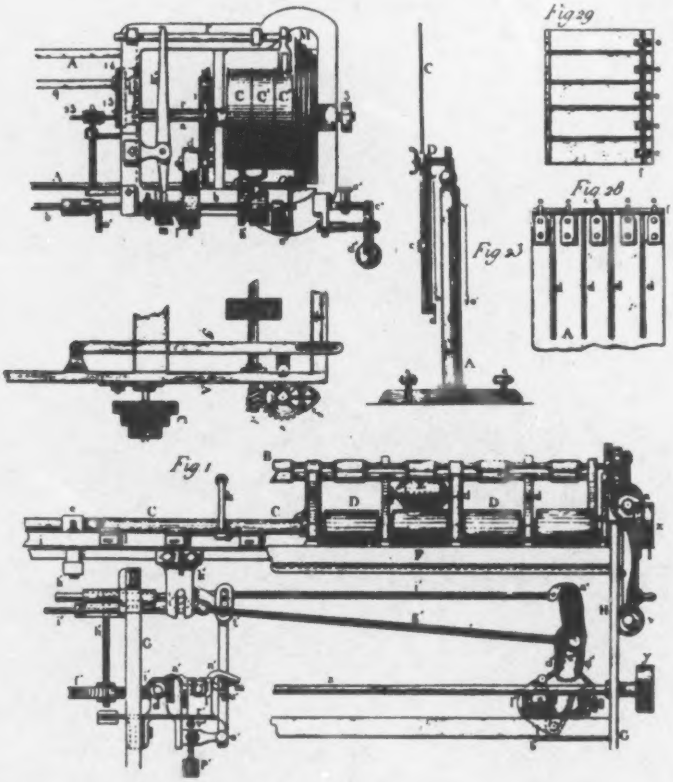
[The lists of courses follow:]

COURSE ON

INNOVATION and ENTREPRENEURSHIP for the 1980's

(ECONOMICS 16)

Offered Fall Quarter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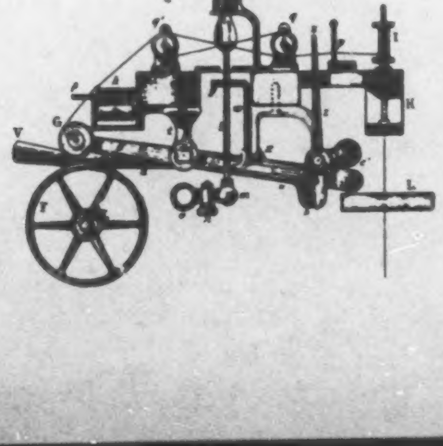
CIED
Center for Innovation and Entrepreneurial Development

Innovation and Entrepreneurship for the 1980's

CIED's first course, "Innovation and Entrepreneurship for the 1980's" is offered under the Economics Board as Economics 16. It is intended for the liberal arts and science student who anticipates a career in business or technology and wishes to acquire the business knowledge and skills needed to create successful, rewarding, and fulfilling activities. "Innovation and Entrepreneurship for the 1980's" has been designed to be that single course which, taken in addition to a student's normal program, would provide maximum benefit towards his or her ambitious career objectives.

The course is led by CIED Director Narinder Kapany, who is joined by other Santa Cruz faculty. A fundamental aspect of the course is the participation of a substantial number of outstanding innovators and entrepreneurs from the business community. Participants in CIED's Winter 1980 course included founders of several companies ranging in size from small to multi-billion dollar internationals, eminent attorneys in business and patent law, and leaders in venture capital and banking.

Group workshops form a major part of the coursework. Students meet in small groups to evaluate an innovation and analyze its technical, market, and financial feasibility. At the end of the quarter they submit a business plan which outlines the development of the innovation into a viable commercial endeavor.



COURSE OUTLINE

Introduction
America's economic problems and the need for innovation and entrepreneurship. Opportunities for individuals in large, small and new companies. Discussion of business concepts and terminology. Discussion and assignment of workshop projects.

The Business Plan
The need for a business plan, its preparation and evaluation. Technological, economic, and societal evaluation of an innovation. Market research: methods and evaluation of techniques.

Protection of an Innovation
Reasons for and extent of protection. Disclosure, reduction to practice; patents, trademarks, copyrights.

Development of an Innovation into a Visible Business Endeavor
Starting new ventures. Problems encountered by entrepreneurs in new or developing businesses. Planning for growth.

Mid-Term: Student Workshop Preliminary Reports

Organizing a Venture
Legal aspects: sole proprietorship, partnership, incorporation, public offering. Management: forms of company organization, authority and responsibility at various levels. Venture capital financing. Banking.

Today's Innovators and Entrepreneurs
Young entrepreneurs, and prospects for the future. Doing business with the U.S. government. International business opportunities. Final presentation of business plans by group workshops.

Final Exam

"By providing the opportunity to develop a "nuts and bolts" approach to innovation and entrepreneurship, CIED is helping me to expand my creativity into productivity."

Richard Lailer, *Kresge College*

"The workshop was a very valuable experience in providing the chance to develop certain skills required for starting a business."

Othello English, *Oakes College*

"Women have not, in the past, thought of themselves as entrepreneurs in business. This course has helped me realize that it can be done, and it's shown me how to do it."

Jeanne Whitworth, *Stevenson College*

"This isn't an easy course and it's not for everyone. But for students interested in someday operating their own business, it is a rare opportunity to actually combine learning with real-life experiences."

Jose Torres, *Merrill College*

"As an independent inventor, I have had a perhaps overly protective view of my own inventions. CIED has shown me the value of creative teamwork, which both enhances my potential and helps make our goal of creating a successful business attainable."

Barry Bosshold, *Independent inventor*

Other CIED courses and activities

- **"Entrepreneurship Part II" (Economics 17)**
- **"Opportunities for Innovation and Entrepreneurship III" (Economics 18)**
- Special workshops
- Seminar Series
- Industrial Affiliates program

CIED

Center for Innovation and Entrepreneurial Development

A University/Industry Affiliation

The Center for Innovation and Entrepreneurial Development (CIED, pronounced "seed") at UC Santa Cruz is the first center of its kind in California. Modelled roughly after innovation centers established by the National Science Foundation at other universities (Carnegie-Mellon, MIT, Oregon, and Utah), CIED has been designed to meet the needs of liberal arts and science students considering careers in business or technology.

CIED's purpose is to encourage and develop the innovative and entrepreneurial talents of students and others so that their activities will benefit both themselves and our troubled economy. Such activities could be either within well-established companies or activities created by starting a new company. CIED will offer courses to develop the knowledge and skills needed for innovative entrepreneurship. CIED's courses will emphasize the practical issues involved in initiating business and technical ventures. Being directly oriented to the world of business and technology, the course requires the participation of people who have demonstrated such abilities. A substantial number of outstanding innovators and entrepreneurs from outside the University are enthusiastically involved in our courses.

In addition to formal course offerings, CIED will sponsor seminars, workshops, and idea-evaluation sessions with distinguished outside speakers. There will be encouragement and assistance for those wishing to develop new ideas into viable enterprises. CIED will help individuals assess specific innovations in terms of technical and commercial feasibility. CIED will also encourage questions as to whether a particular innovation *should* be developed into a commercial product or venture. Societal criteria—social benefit, safety, and environmental impact—will be viewed with strong emphasis.

There will be substantial opportunity for the broad participation of people from the business and technical communities in CIED's activities. University/Industry interaction, through joint development programs, curriculum planning, innovation evaluation, consultation and internships, will be developed to foster a greater exchange of ideas and information and provide a means to share in the solution of common problems. This interaction is being established through CIED's Industrial Affiliates Program.

For more information about CIED, visit or write to CIED, 209 Classroom Building, University of California, Santa Cruz, CA, 95064, or call (408) 429-2980.

ECONOMICS 17

"Entrepreneurship"

Nature of the Course

This is a more advanced version of CIED's first course, "Innovation and Entrepreneurship for the 1980's" (Economics 16). It is the second in a planned sequence of three courses offered by the Center for Innovation and Entrepreneurial Development.

The course is designed for students who envision careers in business or industry and would like one or two courses fairly directly applied to this goal. It is the next step for students who have taken Economics 16, and who would like to pursue the topics covered in that course in more depth. We believe we can package many of the essential aspects of several courses offered in business schools in this course for students with the proper background. Courses of a similar nature have been developed at a number of schools in the last few years and have been exceedingly well received.

Economics 17 will equally emphasize market research, financial planning, and the organization of a venture.

Format

There will be twenty two-hour lectures and ten or more approximately two-hour "laboratory" sessions. Experts from outside the University will present approximately eight lectures on particular topics and will meet with student groups. The laboratory sessions will be organized with groups of about five students working together on extended projects under faculty supervision.

Work to be Evaluated

The student laboratory groups will make mid-term and end-of-the-quarter presentations on their projects. Students will submit papers on each of the three main topics as it relates to their chosen innovation. Attached is the course outline.

Entrepreneurship - Economics 17

Course Outline

I. Market Research

1. The role of market research in assessing a new venture
2. A review of methodologies
3. Advantages, costs, and limitations
4. Market research ethics
5. Analysis of some special cases:
    a. A manufactured item
    b. A service
    c. An energy/environmental product or service
6. Group project

II. Financial Planning

1. The value of sound financial planning and the limitations of plans
2. The significance and preparation of financial schedules:
    a. Balance sheet
    b. Profit and loss statement
    c. Cash flow schedule
3. Various financial accounts: receivables, payables
4. Financing methods, e.g., loans of various types, venture capital, leasing, limited partnerships
5. Legal considerations, e.g., incorporation, partnerships, Chapters 10 & 11, liability
6. Tax considerations
7. Group project

III. Organization of a Venture

1. Corporate organization and management
2. Organization of a production department
3. The commercial significance of a "new" product or service, competition growth curves, follow-ons, etc.
4. The planning and funding of the development of a product or service
5. Group project

Readings

1. Marketing research reader with selections from: Aaker, D. and Day, G. Marketing Research, John Wiley & Sons, 1980; Breen, G.E., Do-It-Yourself Marketing Research, McGraw-Hill, 1977; Kress, G., Marketing Research, Reston Publishing Co., 1979.

2. Financial analysis reader, with selections from: Wall Street Journal, Peninsula Times-Tribune, and eight chapters from J.F. Weston & E.F. Brigham, Essentials of Managerial Finance, 1979.

3. Venture organization reader, with selections from: P.L. Liles, "The Legal Forms of Business Enterprise", in New Business Ventures and the Entrepreneur, 1974; R.M. White, The Entrepreneur's Manual, 1977; K.J. Albert, Handbook of Business Problem Solving, 1980.

ECONOMICS 18

"New Venture Planning"

The final course in CIED's three-course sequence will be offered every Spring Quarter. The prerequisites for this course are Economics 16 and 17. In this course, students will concentrate on a specific innovation and the development of a new start-up venture based upon it. This will involve in-depth market research, financial planning, and the preparation of a comprehensive and realistic business plan. In most cases this will require close collaboration with outside inventor/entrepreneurs. Economics 18 may therefore be structured as an independent field project rather than a formalized class.

GUEST LECTURERS IN CIED COURSES

Sven Arndt

B.A., Economics, University of Western Ontario, 1958; M.A., Ph.D., Economics, U.C. Berkeley, 1964; various teaching posts including UCLA, Stanford, Johns Hopkins, Bologna, Italy, University of Mannheim, University of Constanz, Germany; Director, Office of International Monetary Research, U.S. Treasury; Chairman, Board of Studies in Economics, UCSC.

Albert Bruno

B.S., Industrial Engineering, Purdue University, M.S., Ph.D., Krannert School, Purdue; teaching positions at Naval Post-Graduate School, Harvard, Professor and Chairman of Marketing Research Department at University of Santa Clara.

Papken Der Torossian

M.S., M.E., Stanford University, 1967; Engineering Section Manager, Hewlett-Packard, 1960-72; Manager, Engineering Operations, Spectra-Physics, 1972-6; President, Santa Cruz Division, Plantronics, Inc.

Paul Donovan

B.S. Chemistry, Northeastern University, Ph.D. Nuclear Chemistry, UC Berkeley; Project Director, High Energy Physics, National Science Foundation; Head, Physics section, NSF; Division Director, Division of Advanced Technological Applications, NSF; Director, Office of Energy, R&D Policy, NSF; President, Donovan, Hamster & Rattien, Inc.; Regent's Professor, UCSC.

Courtney Graham

B.A. Economics, Stanford University, 1950; pilot and intelligence officer, WWII; pilot and flight engineer, United Airlines; co-founder of Plantronics, Inc., 1961; Chairman of the Board and CEO Plantronics; retired 1979.

Brad Jeffries

J.D. Stanford Law School; corporate attorney for over 20 years with Cooley, Godward, Castro, Huddleson & Tatum; involved in the setting up, financing and public offering of numerous high technology companies.

Sandra Kurtzig

B.A. Chemistry and Math, UCLA, M.A. Aeronautical Engineering, Stanford University; held positions at TRW, Inc. in food physics and G.E. Timeshare Division as marketing specialist; co-founder of ASK Computer Services, Inc.

Curtis Landi

B.A., Fairleigh Dickinson University, attended NYU, Rutgers University in electrical engineering and computer science; consultant with Patent Researchers Associates in product development and business planning for R&D companies in Silicon Valley.

Norman Lezin

B.A., Political Science, Reed College; served on Santa Cruz Planning Commission, City Council, and as Mayor of Santa Cruz; President, CEO, Salz Leathers, Guest Lecturers, continued

Inc.; Vice-President, Identronics, Inc.; Chairman, Santa Cruz Port District; member of Executive Committee of Tanners' Council of America.

Stuart Marson

B.S., M.S. Chemistry, MIT, Ph.D. Chemistry, Stanford University; NIH Post-Doctoral Fellow, UC Berkeley; co-founder and President, Molecular Design, Ltd. in 1978.

William Martin

Degrees in Electrical Engineering from University of Washington, UCLA; taught engineering for 6 years at UCLA; held executive positions at Telcomp, SCM, and Beckman Corporations; founded Lehntel Corporation, Inc, 1966, merged with Plantronics, Inc., 1978; President, CEO, Plantronics Inc.

Burton McMurtry

B.A., B.S.E.E., Rice University; M.S., Ph.D., Stanford University; Engineering and management positions, GTE Sylvania; President and Director, Western Association of Venture Capitalists; President of Palo Alto Investment Company; partner in Institutional Venture Associates, 1974-80; partner in Technology Venture Investors.

Scott Pine

B.A., Political Science, UC Santa Cruz; co-founder of Digimedics Corporation, Santa Cruz.

Michael Rafton

B.A. Dickinson College, 1947; LL.B., UC Berkeley, 1950; research attorney for California Supreme Court Justice Roger Traynor; private practice, 1951-58; investment advisor, 1958-61; President, California Cargo Containers; President and Board Chairman, Central Bank; founded Central Banking System, 1968; President and Board Chairman, Central Banking System.

Simon Ramo

Ph.D., California Institute of Technology; scientist at General Electric, pioneered microwaves, developed GE's electron microscope; nationally recognized expert in guided missles; Science Advisor to the President; consultant to the White House; co-founder of Ramo-Woolridge Corporation, 1953; held various positions at TRW, Inc., including Vice Chairman, Board of Directors, Chairman of Executive Committee; retired 1978.

Richard Rogala

B.A., Art, University of Michigan; self-taught engineer; developer of desalinization system; founder of Noah Water Systems, 1978.

Judy Sadlier

B.A., M.A., Business Administration, UC Berkeley; Vice President and Branch Manager, Central Coast Region, Dean Witter Reynolds; Santa Cruz Chamber of Commerce, UCSC Foundation, Women's Network.

Guest Lecturers, continued

Vahe Sarkissian

B.A. Physics, American University at Beirut, Lebanon, M.S.E.E. University of Santa Clara; Managing Director, MOS Memory Operations at Advanced Micro Devices, Inc.

Gordon Schontzler

Electrical Engineering, Brown University; member of technical staff, Bell Telephone Laboratories; background in marketing technical products in semiconductors field, scientific instruments, telephone equipment; worked at Varian Instruments Division; founded Beta Technology, Inc., Santa Cruz.

Brooke Seawell

B.A Economics, MBA (Finance), Stanford University; consultant in finance and operations for McKinsey and Touche Ross; co-founded Southwall Corporation in 1979.

Bill Symons

B.S. Business, UC Berkeley; CPA, 10 years public accounting, seven years venture capital; 12 years Vice President, Finance, Plantronics, Inc.

Alex Tennant

B.A. Economics, MBA, Stanford University; corporate analysis and marketing for Evans Products, Inc; President, Lancet Medical Industries, Portland Oregon; Vice President, Marketing, Southwall Corporation.

Charles Townsend

B.A., UC Berkeley, 1942; J.D., Hastings College of the Law, 1948; thirty years federal and state court trial and appellate practice as partner in law firm of Townsend & Townsend; specialist in intellectual and industrial property right law; past Chairman of Patent, Trademark & Copyright Section of State Bar of California; past President of San Francisco Patent Law Association.

Alejandro Zaffaroni

Ph.D., Biochemistry, University of Rochester; post-Doctoral Fellow, NIH; Director, Biochemical Research, Syntex, Mexico, 1951; Vice President, Director, Syntex Corporation, 1968; President, Syntex Labs; founder, President, and Director of Research, Alza Corporation; Chairman of the Board, Dynapol Inc.; recipient of Barren Medal Award for contributions to the field of reproductive physiology.

Harris Zimmerman

B.S.C.E., Illinois Institute of Technology, J.D. Golden Gate College; Registered professional engineer; registered to practice before U.S. Patent and Trademark Office; private practice since 1951 in patent and trademark law; member American Bar Association, State Bar of California, San Francisco Patent Law Association.

Mrs. **Heckler**. I think that would be a very interesting addition to our record. Now, what is your feeling about the current implementation level of the Stevenson-Wydler Act under the circumstances of the program that you're presently under?

Dr. **Kapany**. Well, I gather that there is is no funding for the year 1982 and beyond for the innovation center activity. I think that is an utter disaster.

Mrs. **Heckler**. Do you rely completely on Federal funding? Or do you have other sources of funding?

Dr. **Kapany**. We have so far been funded solely by chancellor's discretionary funds from the University of California at Santa Cruz. We have submitted a proposal to the National Science Foundation for a year's funding. Whereas we are most optimistic about receiving the one year's funding, beyond that we are going to have to be damn entrepreneurial.

Mrs. **Heckler**. If the lessons of your courses are effective, you shouldn't have any difficulty.

Dr. **Kapany**. We'll give it a try. However, as I stated in my testimony, long-term Federal funding would make all the difference.

Mr. **Walgren**. Thank you very much Dr. Kapany. We certainly appreciate it. There's another vote on the floor and I'm afraid we have to go. I have to go.

Mrs. **Heckler**. Yes, I do, too.

Mr. **Walgren**. We will come back and we should not be more than 10 minutes. Thank you very much.

[Recess.]

Mr. **Walgren**. We apologize for the interruptions, but there are measures over there that we have to give some attention to.

The next panel is Patricia Hendel and Robert Cox of the New England Innovation Group.

We're pleased you're here with us and wish that from a budgetary standpoint we were in a better position, but we can learn from what you've been doing and what you think can be done. So we appreciate your coming to the committee to testify.

Written statements will be made part of the record automatically. Particularly at this time of the day, if there are summaries or other ways that you'd like to communicate with us, we'd certainly be interested in your testimony.

[The biographical sketch of Ms. Hendel follows:]

PATRICIA T. HENDEL

ADDRESS

127 Parkway South
New London, Connecticut 06320
(203) 442-1054

EDUCATION:

CONNECTICUT COLLEGE
M.A., with Specialization in Public Finance, 1968.

BARNARD COLLEGE
B.A., with Honors in Economics, 1953.

PROFESSIONAL:

1971-1978 CONNECTICUT COLLEGE
Director of Summer and Evening Sessions.

Developed curriculum with faculty approval for matriculated and non-matriculated graduate and undergraduate part-time students. Full administrative responsibilities, including promotion, registration and staffing. Conceived of a Regional Counseling Center to meet the needs of adults seeking higher education within Connecticut. Wrote successful grant application securing funding under P.A. 140. Structured center with a governing board of all college presidents in southeastern Connecticut, independent, public and the United States Coast Guard Academy. Represented Connecticut College from 1972 to 1978 on Region D, established under auspices of Board of Higher Education. Represented Connecticut College during 1972 on Enrollment Committee of the Master Plan for Higher Education. Instrumental in bringing Elderhostel to Connecticut and developing consortium to present programs on campuses throughout the state to senior citizens.

1970-1971 CONNECTICUT COLLEGE
Special Assistant to the President.

Prepared and conducted a needs study to seek means for Connecticut College to increase its utilization of resources and to serve the general community.

1953-1958 HARVARD GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
Assistant in Courses and Case Writer.

Supervised office staff. Graded papers and assisted in programs for M.B.A. candidates and middle and advanced management programs.

Patricia T. Hendel

PUBLIC OFFICE:

1974-1980 STATE REPRESENTATIVE, 40th District
House Chairman, Government Administration and Elections Committee, 1976-1980.

Instrumental in development and passage of legislation providing for executive branch reorganization, freedom of information and privacy laws and lobbying laws. Higher education reorganization within purview of committee.

ASSOCIATIONS:

1980 to present: NATIONAL INNOVATION NETWORK
Director.

National board of eleven directors which oversees the country's intergovernmental science and technology programs linking public sector needs and productive capabilities to national research and development resources.

1980 to present: THAMES RIVER DEVELOPMENT CORPORATION
Vice-President.

Non-profit corporation dedicated to recreational, commercial and industrial development of the Thames River.

1979 to present: RHODES SCHOLARSHIP SELECTION COMMITTEE FOR CONNECTICUT

1978 to present: NEW ENGLAND INNOVATION GROUP
Vice-President.

New England regional board includes representatives from colleges and universities, corporations and public sector. Devoted to applying technology to public sector needs.

1977 to present: SOUTHEASTERN CONNECTICUT REGIONAL TECHNICAL SCHOOL
Advisory Committee.

1975-1976 CONNECTICUT ASSOCIATION FOR CONTINUING EDUCATION
President.

Performed duties necessary to improve communication among participating independent and public colleges to further mutual and particular goals for continuing education for traditional and non-traditional students.

Patricia T. Hendel

AWARDS:

1978	American Society for Public Administration Outstanding Legislator
1977	Citizens for Better Government through Reorganization Outstanding Legislator
1976	Connecticut Condominium Council Outstanding Legislator

PERSONAL: Born: January 16, 1932, New London, Connecticut

Husband: Seymour L. Hendel, Judge, Superior Court of Connecticut
Children: Douglas, Amherst College, 1978
Clifford, Wesleyan University, 1979
University of Connecticut School of Law, 1983
Caroline, Yale University, 1983

TESTIMONY OF PATRICIA HENDEL, VICE PRESIDENT, BOARD OF TRUSTEES, NEW ENGLAND INNOVATION GROUP, INC., ACCOMPANIED BY ROBERT COX, DIRECTOR, NEW ENGLAND INNOVATION GROUP

Ms. HENDEL. Thank you very much, Mr. Chairman. We do appreciate the opportunity to appear before your subcommittee.

My name is Patricia Hendel and I appear here today in my capacity as vice president of the New England Innovation Group and a founding member of the National Innovation Network.

To my right is Robert Cox, who is director of the New England Innovation Group.

I live in New London, Conn., served in the State legislature where I served as chairman of the government administration and elections committee which has jurisdiction over intergovernmental relations and government structure and organizations.

My town is also the home of the Naval Underwater Systems Center, which is a very fine Federal laboratory and it has certainly sparked my interest in Federal labs.

We are here today to describe to you our perception of the potential of the Stevenson-Wydler Act, the potential it has for mobilizing resources to solve local and State government problems, and the role NEIG and other National Science Foundation sponsored innovation groups can play in this intergovernmental technology utilitization effort.

Success in this important endeavor can only be achieved if the Congress and the executive branch reorganize the pioneering contribution of the Federal laboratories and the NSF innovation group network and factor the lessons learned from these productive partnerships into an accelerated implementation of Stevenson-Wydler's technology transfer objectives.

Dr. Andrew Assur, who is chief scientist at the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, N.H., and a trustee of the New England Innovation Group, has described the situation as follows: "In a competitive world, as we experience today, the efficient use of knowledge and transfer of technology to various sections of the nation is of paramount importance."

Let me digress from his quote to suggest that Mr. Watkins' concern earlier this morning for rural depressed areas, Mayor Jacobson's concern for small communities in the country are equally valid to, broadly based, the entire country and they are equally valid to the 1,500 small towns and communities in New England. And I think that Congressman Brown referred to the broad applicability of this question.

Going back to Dr. Assur:

> The Stevenson-Wydler Technology Innovation Act of 1980 is a step towards accelerating this process, but it is also quite insufficient to make a major impact. As I observe, the high technology departments of the federal government are quite willing to participate, but find it difficult to devote the necessary manpower to share their assets in technological knowledge with other segments of the Nation, as long as manpower spaces are not allotted for such purposes. In other words, R. & D. laboratories should be encouraged to follow their basic desire to cooperate in technology utilization activities, but existing administrative restrictions act to discourage them from doing it. Manpower should be allotted sufficient to fulfill the intent of Section 11 of the Stevenson-Wydler Act.

Dr. Assur's perception of the problem is shared by me and I think by many other local and State government officials and forms the basis for our first recommendation.

We recommend that the Congress should require compliance with that provision in section 11 requiring that each laboratory having a total annual budget exceeding $20 million provide one full-time professional to the task of transferring federally owned or originated technology to local and State governments and to the private sector.

I understand that at the present time less than 25 percent of the approximately 100 Federal laboratories covered by this provision have satisifed this staffing requirement. The resources of the Federal laboratories can only be shared if someone is working at that task on a full-time basis. No Federal agency should be allowed to waive this commitment to active participation in the technology utilization process.

As some of you may know, the New England Innovation Group is the oldest of the multi-State innovation groups. From its modest beginnings nearly 6 years ago through the joint sponsorship of the Rhode Island League of Cities and Towns, the Naval Underwater Systems Center, U.S. Department of Commerce, and the National Science Foundation, we believe we have demonstrated how a successful regional technology utilization program can be managed.

NEIG is particularly pleased that so many of its accomplishments can be traced directly to its success in accessing Federal laboratory resources. However, we are not blind to the fact that these success stories are the results of very individualized relationships with certain Federal labs and people within them rather than the result of a national commitment by the executive agencies or legislation like Stevenson-Wydler or the earlier National Science and Technology Policy, Organization and Priorities Act of 1976.

One of the New England Innovation Group's successes I'm particularly pleased with is the Technology Exposition. When Senator Dodd was still a U.S. Representative from Connecticut's Second Congressional District, my district, NEIG helped sponsor that first effort to showcase for local and State officials the resources of the Federal Laboratory Consortium and neighboring universities.

Congressman George Brown was gracious enough at that time to sponsor a field hearing as part of that 1979 exposition, and out of that I sense came many of the ideas which have been incorporated in the Stevenson-Wydler Act.

NEIG's trustees and staff are especially pleased that the exposition idea was carried on by Senator Mathias in 1980 and this coming October in Albuquerque by Senator Harrison Schmitt who is sponsoring another conference and exposition aptly titled "A Showcase for Technology."

NEIG has prepared, at the request of the Office of Science and Technology Policy, an evaluation of these first two efforts to use the exposition format as a means of introducing Federal R. & D. to the civilian sector.

NEIG would welcome an invitation from this subcommittee to evaluate the Albuquerque program and share our findings with you as part of your continuing oversight responsibilities for Stevenson-Wydler.

No one believing the objectives of Stevenson-Wydler can be pleased with what has happened to its implementation during the first year of its existence. Local and State officials need no reminder as to the nature of our national economic concerns, but many of us are puzzled by the apparent low priority being given by the Federal Government to the greater utilization of Federal R. & D. to help meet pressing local and State needs.

For those of us who have been most closely associated with these issues it appeared that Stevenson-Wydler would provide the legislative base for the national program for technology transfer described in the August 1979 report of the House Subcommittee on Science, Research and Technology, then chaired by Congressman Brown.

The innovation groups were pleased to read in that report, and I quote, that "formal Federal recognition should be given to the system of technology transfer networks which have been established by local governments to assist them to more fully utilize the results of Federal research and development programs."

Two years have elapsed since this recommendation was advanced, and during this period the involved local governments have created the National Innovation Network.

As one of the charter members of the network's policy council, I urge this subcommittee to initiate the Federal recognition process by adopting a resolution which links the innovation groups to the objectives of the Stevenson-Wydler Act. Personally, I think the resolution should challenge each innovation group to join the current national effort to curb inflation by actively identifying and utilizing the results of Federal research and development which can have a significant impact on the productivity and efficiency of local governments throughout the Nation.

I'm sure that NEIG's trustees and local governments throughout our six-State region would respond to this type of opportunity with much greater enthusiasm than they do to the seemingly endless needs surveys and studies, may I add, which seem to influence very few Federal resource decisions.

On a related matter, I have been disappointed to learn that NSF can no longer provide program funding for the Federal Laboratory Consortium. NSF local government funds provided the first seed money for this important coordination and communication function. And I hope that some other Federal agency, such as the Department of Defense, can fill this gap as part of its response to section 11 of the Stevenson-Wydler Act.

OMB's decision not to fund a center for the utilization of Federal technology within the Department of Commerce is not of particular concern to many local and state officials of my acquaintance. Although the Department of Commerce helped initiate NEIG and was a valuable partner in our work with the jewelry industry's electroplating waste disposal problems, it is NSF's intergovernmental program staff which has been fulfilling the six functions mentioned as CUFT responsibilities in section 11 of Stevenson-Wydler.

NSF's staff is definitely more user oriented in its management style and over the years has demonstrated talents in a field where bureaucratic entrepreneurship is essential to success.

Faced with no funding for FLC and CUFT, and recognizing the administration's economic priorities, I would like to offer the following recommendation as a cost-effective means for implementing Stevenson-Wydler's many objectives.

We request that the subcommittee request the National Science Foundation to enter into a cooperative agreement with the Federal Laboratory Consortium and the innovation groups designed to satisfy the policy and program objectives of section 11.

Implemention of this recommendation would be consistent with President Reagan's March 20, 1981, memorandum concerning liaison and consultation with local and State officials. I think this recommendation is also consistent with the statement made this morning by Dr. John Slaughter.

Furthermore, it would provide an opportunity to test the recently formulated guidelines developed by the FLC for working with the public and private sectors.

And I have attached as an exhibit the President's memorandum and the FLC guidelines as well.

Finally, NSF involvement in such a cooperative agreement could help satisfy its section 11 obligations, which I calculate to be about $5 million a year. And that's .5 percent of $1 billion.

Since fiscal year 1981 funding for NSF's intergovernmental program is only $1 million and is scheduled to be terminated in fiscal year 1982, I am really curious as to how NSF can satisfy section 11 unless it initiates some noncash intensive plan such as the one I am suggesting.

My final point concerns the commercialization of technologies of value to local and State governments. Since its inception NEIG has placed a high priority on the aggregation of local and State needs, thereby attracting private sector interest in the transformation of Federal R. & D. into marketable products, processes, and services. We believe NEIG's work in energy management and communications information exchange has been especially successful in attracting private sector participation.

Recent actions by the administration and the Congress now require NEIG to accelerate its commercialization activities while at the same time seeking to replace Federal support for these efforts with private funds. Success in these twin tasks of commercialization and privatization will depend upon our ability to identify incentives attractive enough to excite private sector involvement in solving local and State problems.

Stevenson-Wydler and the full implemention of section 11 could serve as a type of incentive needed to attract private sector participation in the technology utilization process. If section 11 is implemented without waivers by major Federal R. & D. agencies, such as Defense, Commerce, NASA and NSF, it should serve as a signal to both public sector users and private sector suppliers that the Federal laboratory system is to be considered as a national resource from which the maximum return on investment should be obtained.

If my perception of the situation is accurate, then anything short of full implementation will tend to reduce the utilization potential of the products and processes which can be obtained from Federal laboratories and adapted to the benefit of local and State governments.

I am pleased to report to this subcommittee that the New England Innovation Group has taken the lead in seeking private funds to replace those now coming from NSF. In April of this year, NEIG, in cooperation with the Florida and Southwest Innovation Groups, has initiated a modest program to determine the best organizational structure for the continuation of our technology utilization programs; to develop a time line for implementing this strategy, including the identification of public and private membership on a national board of trustees; and to identify private sector expressions of interest in supporting a multiyear financial plan.

Early in August the participating innovation groups will meet to review the progress to date. Since we believe our privatization program is fully consistent with the objectives of the Stevenson-Wydler Act we would be pleased to share our findings with this subcommittee. Your support for the recommendations I have made today should help make the Stevenson-Wydler Act a dynamic source of innovation in our national quest for improved productivity and better living conditions for all our citizens.

We really appreciate the opportunity to testify today, and if we can answer any questions, we would be happy to try.

[The prepared statement plus documents labeled exhibit A and B from Ms. Hendel follow:]

NEW ENGLAND INNOVATION GROUP, INC.

OFFICERS
President
William R. Murphy
Chelmsford, Mass.
Vice President
Mrs. Patricia T. Hendel
New London, Conn.
Secretary & Treasurer
Kenneth F. Payne
Executive Director
Rhode Island League of Cities and Towns

128 N. MAIN STREET
PROVIDENCE, RHODE ISLAND 02903
401-272-3437
ROBERT A. COX, DIRECTOR

TESTIMONY OF

PATRICIA HENDEL
VICE-PRESIDENT
BOARD OF TRUSTEES
NEW ENGLAND INNOVATION GROUP, INC.

presented to the

U.S. HOUSE OF REPRESENTATIVES
SCIENCE & TECHNOLOGY COMMITTEE
SCIENCE, RESEARCH, & TECHNOLOGY SUBCOMMITTEE
HONORABLE DOUG WALGREN, CHAIRMAN
HONORABLE MARGARET HECKLER, RANKING MINORITY MEMBER

concerning the

IMPLEMENTATION OF THE TECHNOLOGY TRANSFER OBJECTIVES

of the

STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980
P.L. 96-480

July 15, 1981
Room 2325 Rayburn House Office Building
Washington, D.C.

My name is Patricia Hendel and I appear here today in my capacity as Vice President of the New England Innovation Group (NEIG) and a founding member of the National Innovation Network. Accompanying me is Robert Cox, Director of the New England Innovation Group. I am a resident of New London, Connecticut and served in the State Legislature where I was Chairman of the Government Administration and Elections Committee which has jurisdiction over intergovernmental relations and government structure and organizations.

We are here today to describe to you our perception of the potential the Stevenson-Wydler Act has for mobilizing resources to solve local and State government problems and the role NEIG and the other National Science Foundation sponsored Innovation Groups can play in this intergovernmental technology utilization effort. Success in this important endeavor can only be achieved if the Congress and the Executive Branch reorganize the pioneering contribution of the Federal laboratories and the NSF Innovation Group Network and factor the lessons learned form these productive partnerships into an accelerated implementation of Stevenson-Wydler's technology transfer objectives.

Dr. Andrew Assur, Chief Scientist at the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire and a NEIG Trustee has described the situation as follows:

> "In a competitive world, as we experience today„ the efficient use of knowledge and transfer of technology to various sections of the Nation is of paramount importance. The Stevenson-Wydler Technology Innovation Act of 1980 is a step towards accelerating this process, but it is also quite

> insufficient to make a major impact. As I observe, the high technology departments of the federal government are quite willing to participate, but find it difficult to devote the necessary manpower to share their assets in technological knowledge with other segments of the Nation, as long as manpower spaces are not allotted for such purposes. In other words, R&D laboratories should be encouraged to follow their basic desire to cooperate in technology utilization activities, but existing administrative restrictions act to discourage them from doing it. Manpower should be allotted sufficient to fulfill the intent of Section 11 of the Stevenson-Wydler Act."

Dr. Assur's perception of the problem is shared by me and many other local and State government officials and forms the basis for our first recommendation.

> THE CONGRESS SHOULD REQUIRE COMPLIANCE WITH THAT PROVISION IN SECTION 11 REQUIRING THAT EACH LABORATORY HAVING A TOTAL ANNUAL BUDGET EXCEEDING $20,000,000 PROVIDE ONE FULL-TIME PROFESSIONAL TO THE TASK OF TRANSFERRING FEDERALLY OWNED OR ORIGINATED TECHNOLOGY TO LOCAL AND STATE GOVERNMENTS AND TO THE PRIVATE SECTOR.

I understand that at the present time less than 25% of the approximately 100 federal laboratories covered by this provision have satisfied this staffing requirement. The resources of the federal laboratories can only be shared if someone is working at that task on a full-time basis. No federal agency should be allowed to waive this commitment to active participation in the technology utilization process.

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One of NEIG's successes I am particularly pleased with is the Technology Exposition. When Senator Dodd was still a U.S. Representative from Connecticut's Second Congressional District, NEIG helped sponsor that first effort to "show-case" for local and State officials the resources of the Federal Laboratory Consortium and neighboring universities. Congressman George Brown was gracious enough to sponsor a field hearing as part of that 1979 Exposition and out of that I sense came many ideas which have been incorporated in the Stevenson-Wydler Act. NEIG's Trustees and staff are especially pleased that the Exposition idea was carried on by Senator Mathias in 1980 and this October in Albuquerque Senator Harrison Schmitt is sponsoring another conference and exposition aptly titled a "Showcase for Technology." NEIG has prepared, at the request of the Office of Science and Technology Policy, an evaluation of these first two efforts to use the exposition format as a means of introducing federal R&D to the civilian sector. NEIG would welcome an invitation from this

Subcommittee to evaluate the Albuquerque Program and share our findings with you as part of your continuing oversight responsibilities for Stevenson-Wydler.

No one believing in the objectives of Stevenson-Wydler can be pleased with what has happened to its implementation during the first year of its existence. Local and state officials need no reminder as to the nature of our national economic concerns, but many of us are puzzled by the apparent low priority being given by the federal government to the greater utilization of federal R&D to help meet pressing local and state needs. For those of us who have been most closely associated with these issues it appeared that Stevenson-Wydler would provide the legislative base for the national program for technology transfer described in the August 1979 report of the House Subcommittee on Science, Research and Technology then chaired by Congressman George Brown. The Innovation Groups were pleased to read on page 43 of that report that:

> "formal federal recognition should be given to the system of technology transfer networks which have been established by local governments to assist them more fully utilize the results of federal research and development programs."

Two years have elapsed since this recommendation was advanced and during this period the involved local governments have created the National Innovation Network. As one of the charter members of the Network's Policy Council, I urge this Subcommittee to initiate the federal recognition process by adopting a resolution which links the Innovation Groups to the objectives of the Stevenson-Wydler Act. Personally, I think the resolution should challenge each Innovation Group to join the current national effort to curb inflation by actively identifying and utilizing the results of federal research and development which can have a significant impact on the productivity and efficiency of local governments throughout the Nation.

I am sure NEIG's Trustees, and local governments throughout the six-state region, would respond to this type of opportunity with much greater enthusiasm than they do to the seemingly endless "needs surveys" which seem to influence very few federal resource allocation decisions.

On a related matter, I was disappointed to learn that NSF can no longer provide program funding for the Federal Laboratory Consortium. NSF Local Government funds provided the first seed money for this important coordination and communication function. I hope some other federal agency, like the Department of Defense, can fill this gap as part of its response to Section 11 of the Stevenson-Wydler Act.

OMB's decision not to fund a Center for the Utilization of Federal Technology (CUFT) within the Department of Commerce is not of particular concern to most local and State officials of my acquaintance. Although the Department of Commerce helped initiate NEIG and was a valuable partner in our work with the jewelry industry's electroplating waste disposal problems, it is NSF's Intergovernmental Program staff which has been fulfilling the six (6) functions mentioned as CUFT responsibilities in Section 11 of Stevenson-Wydler. NSF's staff is definitely more "user oriented" in its management style and over the years has demonstrated its talents in a field where "bureaucratic entrepreneurship" is essential to success.

Faced with no funding for FLC and CUFT, and recognizing the Administration's economic priorities, I offer the following recommendation as a cost-effective means for implementing Stevenson-Wydler's many objectives:

> THE SUBCOMMITTEE SHOULD REQUEST THE NATIONAL SCIENCE FOUNDATION TO ENTER INTO A COOPERATIVE AGREEMENT WITH THE FEDERAL LABORATORY CONSORTIUM AND THE INNOVATION GROUPS DESIGNED TO SATISFY THE POLICY AND PROGRAM OBJECTIVES OF SECTION 11.

Implementation of this recommendation would be consistent with President Reagan's March 20, 1981 Memorandum (Exhibit A) concerning liaison and consultation with local and state officials. Furthermore, it would provide an opportunity to test the recently formulated guidelines developed by the FLC (Exhibit B) for working with the public and private sectors. Finally, NSF involvement in such a Cooperative Agreement would help it satisfy its Section 11 obligations which I calculate to be $5 million per year (0.5% of $1 billion).

Since FY 81 funding for NSF's Intergovernmental Program is only $1 million and is scheduled to be terminated in FY 82, I am curious as to how NSF can satisfy Section 11 unless it initiates some non-cash intensive plan such as the one I am suggesting.

My final point concerns the commercialization of technologies of value to local and state governments. Since its inception NEIG has placed a high priority on the aggregation of local and state needs thereby attracting private sector interest in the transformation of federal R&D into marketable products, processes, and services. We believe NEIG's work in energy management and communications information exchange has been especially successful in attracting private sector participation. Recent actions by the Reagan Administration and the Congress now require NEIG to accelerate its commercialization activities while at the same time seeking to replace federal support for these efforts with private funds. Success in these twin tasks of "commercialization" and "privatization" will depend upon NEIG's ability to identify incentives attractive enough to excite private sector involvement in solving local and state problems. Stevenson-Wydler, and the full implementation of Section 11, could be just the type of incentive needed to attract private sector particpation in the technology utilization process. If Section 11 is implemented without waivers by major federal R&D agencies such as Defense, Commerce, NASA and NSF, it should serve as a signal to both public sector users and private sector suppliers that the Federal Laboratory System is to be considered as a national resource from which the maximum return on investment should be obtained. If my perception of the situation is accurate then anything short of full implementation will tend to reduce the utilization potential of the products and processes which can be obtained from Federal Laboratories and adapted to the benefit of local and state governments.

I am pleased to report to this Subcommittee that the New England Innovation Group has taken the lead in seeking private funds to replace those now coming from NSF. In April of this year, NEIG, in cooperation with the Florida and Southwest Innovation Groups initiated a modest program to:

1. Determine the best organizational structure for the continuation of our technology utilization activities.
2. Develop a time line for implementing this strategy including the identification of public and private membership on a national board of trustees
3. Identify private sector expressions of interest in supporting a multi-year financial plan.

Early in August, the participating Innovation Groups will meet to review progress to date. Since we believe our privatization program is fully consistent with the objectives of the Stevenson-Wydler Act, we would be pleased to share our findings with this Subcommittee. Your support for the recommendations I have made today should help make the Stevenson-Wydler Act a dynamic source of innovation in our national quest for improved productivity and better living conditions for all our citizens. Thank you.

Exhibit A

THE WHITE HOUSE
WASHINGTON

March 20, 1981

MEMORANDUM FOR MEMBERS OF THE CABINET AND AGENCY HEADS

As you know, one of the priorities of this Administration is to restore a proper balance among Federal, state and local governments. Enactment of our Program for Economic Recovery will be an important first step toward achieving that goal.

As we begin this process of restoring federalism to its proper place, each of the departments and agencies will have a role in terms of liaison and consultation with state and local officials.

First, an effective procedure for addressing intergovernmental relations problems should be established within your departments and agencies. Your senior intergovernmental affairs person should be an official of appropriate rank who will have ready access to you and who can be effective in representing you with state and local officials. I encourage you to be in touch with Rich Williamson, Assistant to the President for Intergovernmental Affairs, as you proceed on personnel and other decisions in this area. The White House Intergovernmental Affairs Office will be the central coordinating office within the Administration to oversee intergovernmental relations and the efforts required to implement our federalism objectives.

Second, state and local officials should be consulted about new Administration initiatives affecting their levels of government as such initiatives are being developed to ensure that the programs will be practical and effective. Further, any program, policy, or budget recommendations which you make should include a consideration of what the impact will be on state and local governments.

Third, once programs are enacted, they should be closely monitored to ensure that they do not create any unintended or undesirable effects on state or local governments.

The success of our initiatives will depend in large part on how warmly they are received at the state and local level. That reception will be greatly enhanced if we can have genuine consultations with governors, mayors, state legislators, county executives and other officials at the initial stages of program and policy development.

Ronald Reagan

Exhibit B

FEDERAL LABORATORY CONSORTIUM
FOR TECHNOLOGY TRANSFER

COMMANDER, NAVAL WEAPONS CENTER CODE 3803 CHINA LAKE, CALIFORNIA 93555
PHONE: (714) 939-2305

CHAIRMAN
EUGENE STARK
Los Alamos
National Laboratory
MS 352
Los Alamos, NM 87545

VICE-CHAIRMAN
MICHAEL D'ANGELO
Coast Guard R&D Center

EXECUTIVE DIRECTOR
GEORGE LINSTEADT
Naval Weapons Center

PROGRAM MANAGER
JAMES ATKINSON
National Science
Foundation

PROGRAM MANAGER
CHARLES MILLER
National Science
Foundation

FAR-WEST REGION
GERALD RICHARDS
Lawrence Livermore
National Laboratory

MIDCONTINENT REGION
EUGENE STARK
Los Alamos
National Laboratory

MIDWEST REGION
JAMES JOHNSON
AF Wright
Aeronautical Laboratory

MID-ATLANTIC REGION
JEROME BORTMAN
Naval Air
Development Center

NORTHEAST REGION
BUD GIANGRANDE
Transportation Systems
Center

SOUTHEAST REGION
ROBERT BRANDON
AF Engineering &
Services Center

PUBLIC AFFAIRS
ROBERT ANDERSON
Los Alamos
National Laboratory

June 12, 1981

Dear Colleague,

As you know, one of the purposes of the Federal Laboratory Consortium for Technology Transfer (FLC) is to provide a forum for the exchange of ideas and experiences in order to develop principles and efficient methodologies in this work which we call "Technology Transfer." As part of this, the FLC membership has long seen the need for a body of general guidelines for use in working with individuals and groups in the public and private sector - the users of our technology. With the passage of the Stevenson-Wydler Technology Innovation Act, the need for such guidelines is even more pressing, and we ask your help in our efforts.

Since no one of us has the breadth and depth of experience and knowledge in this field (nor the time) to prepare such guidelines, the FLC has chosen to use a Task Force approach. In this way, we can draw on the specialized knowledge of many people while, at the same time, minimizing the amount of effort required by each participant.

Mary-Margaret Jenior, of DOE's Office of Building Energy Research and Development, has kindly agreed to coordinate the Task Force activities. As a start, she has prepared the enclosed draft outline of the topics which may be included in the completed document. In the very near future, Mary-Margaret will contact you to discuss areas in which you may be willing to contribute to this effort.

We sincerely hope that you will find some time to work with us on this very important task, and we welcome your comments and suggestions on this and in other of our efforts to improve the process of Technology Transfer.

Charles F. Miller

James E. Atkinson

NATIONAL SCIENCE FOUNDATION, SPONSORING AGENCY

OUTLINE FOR ESTABLISHING GUIDELINES: SERVICES TO STATE AND LOCAL GOVERNMENTS AND THE PRIVATE SECTOR

Subgroup 1: Types of Assistance and Competition Issue

A. State and Local Governments

1. Kinds of assistance laboratories could provide:

    a. Reviews, as of technical plans for facilities and RFP's;

    b. Advice, as on technical options and how to compare them, on the testing of select products, and on computer programming;

    c. Performance of tasks, e.g., preliminary feasibility analyses, adaptation of products developed in Federal laboratories, execution of select research needs and access data bases.

    d. Facilitating linkages to other resources that can assist state and local governments; and

    e. Problem definition.

2. Relationship to private sector, i.e., determination of services or levels of services that do not constitute competition with the private sector:

    a. Services not available or available at only excessive cost in the private sector;

    b. Proposed tasks fall within a laboratory's area of expertise; and

    c. Activities limited to prototype units and the testing of concepts.

3. Guidance for helping state and local governments define or clarify the problems on which they seek assistance.

B. Private Sector

1. Kinds of assistance laboratories could provide:

    a. Advice, as on testing and production procedures;

    b. Development of prototype units;

    c. Ideas as to applications of products/procedures developed for Federal purposes; and

    d. Facilitating linkages to other resources.

2. Services or levels of service that do *not constitute* competition with other elements of the private sector:
   a. Services not available elsewhere;
   b. Proposes services require an unique expertise;
   c. Activities limited to prototype products and the testing of concepts; and
   d. Proposed services fall within a laboratory's area of expertise.

C. References

1. OMB Circular A-97;
2. NIN-FLC experience in problem definition in their joint program experiment;
3. SIG's/experience in using laboratories in its Garden Grove project; and
4. Operating Policy of the Department of Defense Technology Transfer Consortium (Report by the Department of Defense to the Committee on Appropriations, U.S. Senate, January 1979).

Subgroup 2: Cost Sharing and Reimbursement Policies

A. State and Local Governments

1. Amount or type of service(s) that should be provided free of charge;
2. Amount or type of service(s) that should be provided on a reimburseable basis or a cost sharing basis;
3. Activities or services that constitute an "in kind" contribution toward cost; and
4. Procurement or agreement policies and practices of individual agencies.

B. Private Sector

1. Amount or type of service(s) that should be provided free of charge;
2. Amount or type of service(s) that should be provided on a cost reimbursement or payment in advance basis; and
3. Procurement or agreement policies and practices of individual agencies.

C. References

1. OMB Circular A-97;
2. Code of Federal Regulations on procurement;
3. LLL Administrative Memo, Vol. 11, No. 13, March 25, 1981; and
4. State and local government procurement laws.

Subgroup 3: Administrative/Management Procedures

A. State and Local Governments

Process for receiving and assigning priortiy to requests for assistance:

1. Methods for accepting requests (i.e., written vs. telephone requests, to whom requests should be directed, who the requesting official should be--chief administrative officer, department head and/or elected official);
2. Types of information the request for assistance should contain;
3. Merits of having both administrative and elected officials endorse requests requiring more extensive efforts or time; and
4. Procedures and policies for encouraging individual jurisdictions and agencies to channel requests through brokering organizations (like, the National Innovation Network).

B. Private Sector

Procedures for encouraging and receiving requests for services and assigning priority to such requests:

1. Methods for making private sector aware of R&D having potential non-Federal applications;
2. Screening of requests for appropriateness and priority;
3. Policy vis-a-vis brokering organizations; and
4. Methods for accepting requests (e.g., evidence of commitment on the part of requesters, capital resources, entrepreneurship knowhow, marketing plan).

C. Administrative Procedures within the Laboratory

   1. Record keeping--

      a. Types of requests, and

      b. Level of effort required to respond to requests; and

   2. Systems and data needed to determine relative effectiveness of efforts.

D. References

Subgroup 4: Patents and Proprietary Information

A. Patents, Licensing and Dealing with Proprietary Data/Information

   1. Patent and licensing laws and/or practices which hinder or might hinder technology transfer; and

   2. Specific changes required in such laws and/or practices.

B. References

   1. PL 96-517;

   2. Title 35, United States Code; and

   3. Code of Federal Regulations, e.g., 41CRF Part 9-9

Mr. WALGREN. Well, we appreciate that very much.

Remembering the last time NEIG was here—were you here then, Mr. Cox?

Mr. COX. I was here with some of my trustees, yes.

Mr. WALGREN. I don't know how long ago it was. It seems time goes by pretty fast and the circumstances keep changing.

Mrs. Heckler?

Mrs. HECKLER. Well, I would just like to compliment you on your testimony. Obviously, you have had a very promising experience and the record is, I think, extremely favorable. It deserves to be officially noted.

What I wonder is, What return do you think the taxpayer is getting for the Federal investment in your project?

Ms. HENDEL. I think the taxpayers are getting a return from the utilization of the moneys that are spent in our Federal labs. I mentioned before that I happened to live in a town with the Naval Underwater Systems Center, a very fine Federal lab. I also live in a town that has 52 percent of its land tax exempt and in an area where we need a great deal of economic development. The extent to which a group such as NEIG has helped to access the skills, the expertise that are found in that Federal lab that is supported by Federal dollars for State and local government uses is a very direct return to taxpayers in a very clear sense. I think that rather than a lack of understanding or often hostility for even tax exempt facilities, we're maximizing the benefit of a very special kind of resource and R. & D. So that to the extent that we have been able to help provide the networking to make possible the utilization of the resources of Federal labs I think the taxpayers are getting something for their dollars.

Mrs. **Heckler**. Mr. Cox, would you like to speak to that question?

Mr. **Cox**. I would like to add on two examples, and one will be close to your home, the Natick Lab. But first, in talking to Dr. Assur at the Cold Regions Laboratory, about 4 years ago, with a modest investment of $7,500 of NSF funds, we initiated a building diagnostics program built around the technology of thermography. To the best of my knowledge the individual who was released to us to transfer that technology is now being considered for heading up a building diagnostics program at the Army Cold Regions Laboratory based upon an experience he has since received working with the Canadian Government as a result of our interchange across the international boundary.

I wasn't successful, nor were any of my trustees, in convincing people here in Washington that we ought to pay more attention to building diagnostics. But the Canadians came down and simply wowed the people here, and as a result somebody in the Army Corps of Engineers is all hot to create something like they have in Ottawa.

That American citizen, that Federal lab employee, will be coming back to New England and be available onsite to help us do that. The synergism of $7,500 4 years ago, it seem to me, is like trying to count the grains of sand on the beaches down on the Eastern Shore. Too difficult to even attempt. You might as well just enjoy it as you see it. [Laughter.]

The Natick Laboratory, as you know, is a premier laboratory for food and clothing research. You know the problems we have with aging; you know the problems of even trying to deal with ethnic meals so that we don't destroy the cultural character of our region. If that laboratory had a full-time technology transfer person, and not Dr. Baily, who is now retired and just coming back on a temporary basis, it would be easy for the school districts in Massachusetts, Rhode Island, and Connecticut—it's just an ideal location—to access that kind of expertise. They want to do it. But people, if they can't get inside and take advantage of all that gigantic research that takes place at Natick, they're just going to be resistant to making that move. And therefore there is no return on that kind of investment.

Mrs. **Heckler**. Would you describe the building diagnostic program?

Mr. **Cox**. What we've attempted to do is influence what is really known as title III of the Schools and Hospitals Energy Conservation Act. There's a variety of techniques that have been developed for identifying excess heat loss from a variety of buildings.

One of the things that has been done, for example, is with the Internal Revenue Service building in Andover, Mass. I think that's about 7 acres of rooftop. The building was perpetually leaking. As a result of the application of thermography, the GSA decided not to replace 7 acres of roof; they merely replaced that small portion, which I think was actually less than an acre, and thereby saved the taxpayers an enormous amount of money. And that's an example of that sort of a thing.

The other thing that's been done is that we have convinced, for example, Governor Garrahy in Rhode Island to take and to use thermography as a quality control technique on all the energy audits that are done in all the work that is completed by contractors that have been authorized by his office as to being qualified to do work.

We are also doing similar kinds of research in cooperation with the National Bureau of Standards on the application of building diagnostic techniques to the weatherization of low- and moderate-income housing. And that's being done in 10 cities across the country.

Mrs. HECKLER. Are any of those cities in New England?

Mr. COX. Yes. We parlayed the money into more cities than we were supposed to. There were cities in all regions of the country.

Mrs. HECKLER. Did you pioneer the building diagnostic tests?

Mr. COX. Absolutely not. We were the adapters of that technology that had its roots in the vision and the courage of a Federal laboratory employee who bucked his management beginning in 1974. And we got him on loan from that Federal laboratory because I think his management was just as happy to get him out. Now, he's likely to go back and get about a two-step jump in grade.

Ms. HENDEL. And replace the management, hopefully.

Mr. COX. Yes, there are some of us that would like to have seen that done a couple of years ago. But in general, the success we have had has not been with the management.

I'll ask you, when is the last time you saw the top director of a Federal lab testify in front of your subcommittee? Go back through your records. They're not there. It's the Mrs. Hendels that are here who know the value of their labs, and I would submit that that might be a serious omission in their public management responsibilities. They ought to be asked to testify on section 11, not the Assistant Secretary of Defense for Research and Development. Go to the heart. Go to the lab directors. Get them to tell you what they are doing. Many of them we'll find out that there are people in their labs doing very, very exciting things that are giving double mileage for the dollars that are being invested in those labs.

Mrs. HECKLER. How many laboratories are there?

Mr. COX. Well, I would say there are more than 200. We have about 13 of them in my region, and if my colleagues Jim Atkinson and Chuck Miller are here—they carry that number at their fingertip like I do, the 1,589 local governments in New England who collectively spend $18 billion a year.

Mrs. HECKLER. What success have you had with the local governments in terms of their amenability to changes as you have proposed them?

Mr. COX. I would not attempt to answer that when I have an elected official on my left.

Pat?

Ms. HENDEL. I think we've had some significant success as local and State governments are aware of the need for them and the availability of the techniques that we have made available. As you know, local and State governments have practically no R. & D.

ability. They just can't function that way. And there's another difficulty in that local and State officials are not in office for a long time. They tend to look for short-run payback rather than longer range things, and that makes planning difficult. But we work with the municipal leagues throughout the region and we work with State governments.

In my State of Connecticut, we have been partly funding and have been the stimulus for a technology agent in financial management working for the Office of Policy and Management in the State. This person's job is to bring 20th century management techniques to a lot of our small towns which have part-time or no-time financial managers.

The need for this is identified by the town. They did not have the ability to solve it. And what we've been able to do is, when a need has been made apparent, help link either through communications devices or an agent helping with processes, management type processes, or even techniques like infrared thermography.

So I think that we're building a constituency, if you will, of concerned local and State officials who know that particularly with the pressures of budget which exist, and also with the emphasis on a reordering of Federal, State, local government functions that they're going to have to utilize advanced technology, and even some technology, in order to serve their citizens in the 20th century.

Mrs. **Heckler**. Thank you very much.

Mr. **Walgren**. Thank you, Mrs. Heckler.

In the cooperative agreement that you recommend with the NSF reaching out to the Federal laboratories and the innovation groups to satisfy the objectives of section 11; would that cost money?

Ms. **Hendel**. I don't see how it would. And I think what we would get instead is a recognition of the role of the innovation groups and their necessary part in the process.

Among other things, as we are trying to—I hate some of these jargon kinds of words—seek replacement of Federal funds with private sources—and we've labeled it "privatization"—as we go in directions such as that and find that we are talking to corporations and other interested groups, we need to have, I think, a clear statement in an act that it's recognized that innovation groups and the consortium and NSF are part of this whole process. And we have no status as it stands today. Since funding of CUFT is not, I guess, in the immediate future, I think this would serve as a noncost way of establishing something that I think is very important.

Mr. **Walgren**. If you would perhaps draft a suggestion, some suggested language, and send it to the committee staff. I know we would like to talk among ourselves about what we may be able to recommend to NSF as a body, if not a formal piece of legislation, at least a statement from those of us that are particularly interested in the area. And the same thing is true with your suggestion of a resolution with respect to the inflation impact on local government. We'd like to talk with you about that and I know there are members of the committee who would be interested in urging NSF directly to engage in those activities. We're limited in that they will not spend money unless we get both the House and the Senate to concur with us in how they should do that, and the President, too. But certainly in the area of cooperating with and including innovation groups in on efforts that are being made, we hope they would want to do that on their own, and perhaps we can encourage them in that direction.

Ms. **Hendel**. Thank you. We would be happy to comply with that.

Mr. **Cox**. As a native Philadelphian, Mr. Chairman, and I know you come from the sister city of Pittsburgh, I'd like to just say that all we're trying to do is what the Pittsburgh Pirates have been trying to do. We're trying to be family. And there is no family here between NSF and the consortium and the innovation groups in the sense that people are there but nobody knows about it. And it makes it very tough for us to go out and talk about the legitimacy of the Federal labs to the First National Bank of Boston if there's not much visibility to that legitimacy, and the best legitimacy we can have is something that comes from the Congress of the United States backed up by people like Dr. Slaughter and the National Science Board. That would help.

Ms. **Hendel**. If I may add, I was listening to Dr. Kapany earlier. I was thinking that he really should be in touch with, for example—I don't know if he's still here—the Southwest Innovation Group. In New England, for example, we have used the Federal labs and the universities, Brown University and the University of Rhode Island and the University of Massachusetts as part of the whole network to make these things happen. And maybe with the kind of resolution we're talking about and a somewhat formalizing of a relationship it would become apparent that these resources exist and could be used.

Mr. **Walgren**. Well, I thank you very much for coming.

We look forward to receiving something from you along that line.

With that, that ends today's hearing, and we will be back tomorrow morning at 9 o'clock.

[Whereupon, at 12:48 p.m., the hearing was adjourned, to reconvene at 9 a.m., Thursday, July 16, 1981.]

IMPLEMENTATION OF PUBLIC LAW 96-480, THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

THURSDAY, JULY 16, 1981

House of Representatives,
Committee on Science and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met at 9:14 a.m. in room 2325, Rayburn House Office Building, Hon. Doug Walgren (chairman of the subcommittee) presiding.

Present: Representatives Walgren, Shamansky, and Ertel.

Also present: Representative Watkins.

Staff present: Thomas H. Moss, staff director; Thomas R. Kramer, science consultant; David L. Rheem II, minority technical consultant.

Mr. Walgren. Good morning.

We appreciate your coming to the last day of our hearings on the Stevenson-Wydler Act and its implementation. Today we have a full schedule of witnesses and I would like to generally invite you to summarize rather than read lengthy statements in hopes that everyone's time consideration will be accommodated.

It is also more helpful to the committee to be able to talk more informally and it is also true that any written statements that you have will be made a part of the record automatically. So, they will be there regardless. So, we hope that we can get through this list of witnesses in good time this morning.

The first panel is a panel from the Federal agencies, Mr. Anson Bertrand, the Director of the Science and Education Administration with the Department of Agriculture; Antionette Joseph, with the Office of Energy Research, Department of Energy; Al Linhares, Director of Technology Sharing, from the Department of Transportation; and Floyd Roberson, Director of Technology Transfer Division, with NASA. If those folks could come forward, we would be happy to have your views on where we are with the Stevenson-Wydler Act.

I understand that Mr. Bertrand has a time problem. If you would like to lead off, that will be fine.

[The biographical sketches of Ms. Joseph, Mr. Linhares, and Mr. Roberson follow:]

U.S. Department of Energy
Speakers Bureau
Office of Public Affairs
Washington, D.C. 20585
202/252-5644

BIOGRAPHY

ANTIONETTE GRAYSON JOSEPH

Antionette (Toni) Grayson Joseph is Associate Director, Office of Field Operations Management, Office of Energy Research, Department of Energy (DOE). In this post, she supports the Director of Energy Research in the task of overseeing the field installations of DOE and associated laboratory, university, and industrial relations. She has held this post from April 1979 to the present.

Before returning to the Washington, D.C. area, Ms. Joseph was Special Assistant to the Manager, San Francisco Operations Office. She served as executive adviser to the Manager and Deputy Manager of the Operations Office from October 1976 to April 1978, and assisted in the management and direction necessary to accomplish assigned programs and missions. During this same period, she maintained liaison with DOE headquarters and contractors on overall management and administrative matters.

Previously, Ms. Joseph served as Chief of Operations and Facilities, in the Office of the Assistant Administrator for Field Operations in the DOE's predecessor agency - the Energy Research and Development Administration (ERDA) -- where she was responsible for the overview of Operations Offices, laboratories, and Energy Research Centers. She undertook special management and organization studies affecting broad ERDA policies toward its field facilities and resources; she was staff director of the "Field and Laboratory Utilization Study."

She worked, in 1974, as adviser to the Rockefeller Commission on Critical Choices for Americans where she was in charge of planning staff studies of energy problems and possible solutions.

In the period of transition from the former Atomic Energy Commission (AEC) to ERDA, Ms. Joseph was Executive Director, Laboratory and Field Coordination under both DOE predecessors. She provided liaison functions relating to research and development conducted by contractor laboratories. Prior to that time, she was Staff Assistant to the Assistant General Manager for Energy and Development Programs, AEC.

From August 1967 to August 1970, Ms. Joseph was Staff Assistant to the Special Assistant for Disarmament. She carried out duties related to administrative, international, and political aspects of arms control and disarmament and she maintained liaison with the Arms Control and Disarmament Agency (ACDA) and with other Executive and Legislative Branch offices. She joined the AEC's Office of the Secretary in May 1964, and served in capacities of increasing responsibility until 1967.

Ms. Joseph received a B.S. in education from Indiana University of Pennsylvania in 1962; an M.A. from the University of Missouri in 1963; and an M.B.A. in public administration from Harvard University's Kennedy School of Government in 1971. She is a resident of Bethesda, Maryland.

October 1979

7/81

Biographical Summary

Alfonso B. Linhares

Mr. Linhares is currently Director of the Office of Technology Sharing in the Office of the Assistant Secretary for Governmental Affairs within the Office of the Secretary at the U.S. Department of Transportation. This Office has prime responsibility for coordinating Department activities aimed at achieving improved federal/state/local/industry interaction to assure (1) user input to research, development and demonstration activities of the Department, and (2) maximum transfer and utilization of the resultant products and knowledge. Prior to this he held the position of Chief of the R&D Policy Analysis Division, where the technology sharing activities were initiated as part of the responsibility for evaluations to assist in guidance of the Department's R&D programs.

Mr. Linhares served as Chairman of the Committee on Domestic Technology Transfer under the Federal Council for Science and Technology and its successor, the Federal Coordinating Council for Science, Engineering and Technology. He has authored numerous reports and papers on the subject of technology transfer and related issues, and has been the main speaker at many forums on the subject.

Prior to joining the Department in 1970, Mr. Linhares was Manager of the Operations and Systems Analysis Group of the Los Angeles Division of Rockwell International. He joined the Division as an analyst in 1960, coming from Douglas Aircraft Company, where he began his career as a design engineer in 1959. He received an Aeronautical Engineering degree with high honors from the Pennsylvania State University in 1959. Prior to this he served four years in the U.S. Navy as an aircrewman and electronics engineer.

His activities in the field of technology sharing/transfer have been recognized by a number of awards including two from outside the Department. One was from the Federal Laboratory Consortium, "in recognition of his contributions to the support of technology transfer." The other was from the Urban Consortium for Technology Initiatives, "in grateful acknowledgement of his many contributions and his successful effort to bring about wide use of innovative technology in the management and operation of transportation systems."

NASA
National Aeronautics and
Space Administration

Washington, D.C.
20546

Biographical Data

Floyd I. Roberson
Director, Technology Transfer
Division

Named Director of NASA's Technology Transfer Division in March, 1978, Floyd I. Roberson supervises approximately 70 projects a year which develop new commercial products based on the technology developed for NASA's space program.

He also is responsible for training state and local governments and the private sector in the use of satellite remote sensing data and information in natural resource management and planning; for the grant programs at 22 universities which develop and promote the use of space applications in a wide variety of disciplines; for supervising a network of seven Industrial Application Centers which provide technical data base search services to industrial clients; and for the publication of NASA Tech Briefs which describes new NASA inventions, innovations and processes.

Roberson joined NASA in 1962 at the space agency's Jet Propulsion Laboratory in Pasadena, Calif. He received his bachelor's degree in electrical engineering from Washington State University at Pullman, Wash., his master's in systems engineering from West Coast University in Los Angeles, and a master's in management from Stanford University, Palo Alto, Calif.

He was awarded the NASA Medal for Exceptional Scientific Achievement in 1971 and held an Alfred P. Sloan Fellowship, NASA Award, Stanford Graduate School of Business 1976-77.

Roberson was born in McAlester, Okla., Feb. 21, 1937. He is married, has one child and resides in Arlington, Va.

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February 1980

TESTIMONY OF ANSON BERTRAND, DIRECTOR, SCIENCE AND EDUCATION ADMINISTRATION, DEPARTMENT OF AGRICULTURE, ACCOMPANIED BY THEODORE J. MAHER, COOPERATIVE EXTENSION SERVICE, DEPARTMENT OF AGRICULTURE; ANTIONETTE JOSEPH, OFFICE OF ENERGY RESEARCH, DEPARTMENT OF ENERGY; AL LINHARES, DIRECTOR OF TECHNOLOGY SHARING, DEPARTMENT OF TRANSPORTATION; FLOYD ROBERSON, DIRECTOR, TECHNOLOGY TRANSFER DIVISION, NASA

Mr. **Bertrand**. Thank you, Mr. Chairman. I appreciate the opportunity to appear before the committee and to discuss the Department of Agriculture's program in response to the Stevenson-Wydler Technology Innovation Act of 1980. Accompanying me this morning is Dr. Theodore J. Maher, who is program leader for local government community and rural development in the Cooperative Extension Service of the Department of Agriculture. He will be able to stay, Mr. Chairman, after I have to leave.

Mr. **Walgren**. Fine.

Mr. **Bertrand**. As you have requested, I will proceed with a brief summary.

Through its network of in-house and land grant university cooperators and the extension system, the USDA has had a long history of technology transfer as a specific mission. The USDA has recognized technology transfer as a specific mission for many, many years. So, in a sense, Public Law 96-480—and particularly section 11—has reendorsed our long-standing commitment to emphasizing technology development and transfer through research and extension.

In keeping with the spirit of the act, our research efforts in the Department, involving the Agricultural Research Service, the Cooperative State Research Service, the Forest Service, Ecomonics Research Service, and others, continue to have a user-orientation in all of those activities. Adviser groups are numerous, and include adviser groups of users. They help us shape our programs at all levels. We think our technology and our technical information systems, our extension system, and other channels for the flow of information are working quite well. We understand the increased emphasis that Congress has placed on this issue and we intend to accelerate our activities in this area.

In our R. & D. work, we stress the positive institutional relationships involving the sharing of knowledge with Federal agencies, with universities, with private enterprise and with other interest groups as well as the private concerns. As you know, Mr. Chairman, the Department of Agriculture is greatly decentralized. This has been done in order to maximize interface between the activities of the Department of Agriculture and the users. USDA maintains over 150 research locations in the United States, field stations, where research is under way. These operations, both in the Agricultural Research Service and in the Forest Service are cooperative with the 50 State land grant universities. This network provides for a constant interactive process between the development of new technology and the user.

In this orientation toward technology transfer, we recognize that in order to maintain productivity and to stimulate technology innovation we must accelerate the activity and we must accelerate the time lag between development and user. We are working to implement those kinds of things. We recognize that we must share our research results not only with the business community, which is our traditional client, but also with State and local governments to an extent that we have not done in the past. These linkages are important because the vitality of agricultural production, water supply, preservation of prime agriculture land and many other factors that attract our attention day after day have great impact on local governments and State governments and the programs they wish to carry out.

When Public Law 96-480 was passed, I appointed a task force to make recommendations on USDA responses. We believe that we have research to offer all these sectors referred to in the legislation, both public and private. Research can and is being applied to areas such as disposal of municipal sewage, land use, soil conservation, alternative energy, pest management and many, many others.

To accomplish and utilize the research by private and public users, we certainly support the notion of assessment of relevant research, of technical assistance and of information sharing, and our programs are planned with that in mind.

As a specific pilot program in this area, done with local governments, we are exploring the possibility of teaming agricultural research, cooperative research—from the land grant universities and the extension system and local governments in a joint venture that would directly link some of our laboratory R. & D. with local problems. This is being worked out under the auspices of the U.S. Conference of Mayors. Some specific pilot programs will be undertaken. We also plan to explore new ways of linking research results from the USDA laboratories and other sources more directly with the users through our extension program to reach new audiences.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Bertrand follows:]

STATEMENT OF

DR. ANSON R. BERTRAND

DIRECTOR, SCIENCE AND EDUCATION

U.S. DEPARTMENT OF AGRICULTURE

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY

COMMITTEE ON SCIENCE AND TECHNOLOGY

U. S. HOUSE OF REPRESENTATIVES

July 16, 1981

Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before you today to discuss the Department's activities relating to the "Stevenson-Wydler Technology Innovation Act of 1980." Accompanying me today is Dr. Theodore J. Maher, Program Leader, Local Government, Community and Rural Development, Extension Service.

The intent of this Act is "to promote United States' technological innovation for the achievement of national economic, environmental and social goals, and for other purposes."

This Department supports these activities and wishes to take this opportunity to focus on a few points to consider in reviewing actions taken to promote technological innovation within the business sector that supplies our country and its customers with quality food and fiber. Within the intent of Section 11 of Public Law 96-480, we also support the use of technology in support of problem solving for local and state governments. Our research work in soil conservation, pest management, alcohol fuels, and other areas has potential secondary application for critical citizen needs.

The first point to be made is that the Congress of the United States has passed legislation for more than a century authorizing and appropriating funds for the development of new agricultural technologies in university and Federal laboratories and transferring information to users through the Cooperative State Extension Services.

The Joint Council on Food and Agricultural Sciences is composed of representatives from USDA agencies with significant research, extension, and teaching responsibilities, the Office of Science and Technology Policy, land-grant colleges and universities, state agricultural experiment stations, cooperative extension services, and other institutions, producers, and the public.

The primary responsibility of the Joint Council is to foster planning and coordination of agricultural research, extension, and teaching activities among the public and private partners in the food and agricultural sciences.

The National Agricultural Research and Extension Users Advisory Board (UAB) is made up of 21 citizens representing diverse food and agricultural views and interests from producers to consumers.

The UAB prepares independent advisory reviews for the Secretary on food and agricultural sciences, including review of policies, plans, and goals of relevant federal programs; on the extent of private foundations' and businesses' agricultural research and extension, and their relationship to the Federal effort; and on the overall adequacy of the distribution of resources appropriated under Title XIV of the 1977 farm bill.

The Agricultural Research Service conducts research to provide the means for a safe, economical, and abundant supply of agricultural products for the Nation. More than 2,700 scientists perform research at 148 locations in the 50 states, Puerto Rico and the Virgin Islands, with programs responsive to producer and consumer needs from the farm to the dinner plate.

The Cooperative State Research Service Staff is involved in research program planning and coordination, encouraging cooperation among the states and between the states and their Federal research partners.

The Extension Service, which dates back to 1914, is the largest off-campus informal education system in the world. Its resources include support from Federal, State, and County governments; nearly 18,000 professionals, 6,000 program aides, several hundred thousand volunteers, and an office in virtually every county in the country, and programs in Puerto Rico, Guam, and the Virgin Islands.

The Department has a uniquely successful record in carrying the message of new technologies to the users on the land. Now, with the implementation of Public Law 96-480, we will build on past successes, focus on future needs, and sharpen our delivery system.

Agriculture in the United States now has assets valued at $900 billion and generates employment of 20 percent of the work force. It not only provides food and fiber for the citizens of this country, but also provides a substantial cash flow into the United States through sales of exported commodities.

The rate of increases in productivity in agriculture, which may appear to decline slightly, is still substantial.

Therefore, we believe the United States Department of Agriculture has had, for an extended period of time, programs in effect which honor the intent of Public Law 96-480. However, realizing that improvement is always possible, after the passage of the law, I appointed a task force to:

- Examine existing policies and practices relating to external use of laboratories engaged in research for agriculture and human nutrition;
- Review the resources and potentials of laboratories for assisting public and private users; and
- Suggest workable approaches to achieving optimum use of these resources in meeting identifiable problems.

That task force has reported a number of options pertaining to implementation of Section 11 of the Technology Innovation Act, and we are actively exploring those alternatives.

For USDA and other agencies to reach the business, state, and local constituency with laboratory research results, at least four requirements are mandated by the legislation. They are (1) systematic assessments of available laboratory research, (2) technical assistance to users in tailoring and adapting R&D results to meet cost and performance criteria, (3) information dissemination, and (4) coordination with other Federal agencies.

1. Research Assessments

The research assessments provision requires the laboratory to devise a system for communicating possible secondary applications of research to producers and users. What is required to be provided are reports in readable language and in standard format abstracts of technological applications by research facilities on promising developments to the user community. The identification, collection, and dissemination of this kind of assessment is currently undertaken by Extension Service, Agricultural Research Service laboratories, and the National Agricultural Library in a cooperative effort at packaging and delivery.

2. Technical Assistance

Another important mechanism for linking the supplier and the user is personal relationships. Given the nature of the technology transfer process, person-to-person interaction through technical assistance is as important as documentation strategies. One strategy for providing technical assistance to local governments is being explored by USDA in cooperation with the U. S. Conference of Mayors. Under the arrangement, the Agricultural Research Service and the Extension Service would become part of a back-up support mechanism for one or more of the local pilot sites identified by the Conference of Mayors. Extension Service would continue to serve as the link between the developer of the technology and the users, thus facilitating its application.

3. Information Flow

Despite the genuine desire of most Federal R&D centers to apply their resources to problems of public and private organizations, there is a general lack of information flowing from these laboratories that can be used by the public and private sectors. There are published compendiums containing thousands of pages of outline descriptions, but usually only one or two pages are devoted to each facility. This information is too unwieldy to be very useful. Also, changes occur with a frequency that readily outdates much of the material. The information dissemination role identified in Section 11 is a critical one.

Two steps are needed to bring the laboratories into focus on problems and potential solutions for the user community. The first is to establish a clear statement of what the respective laboratories have to offer and what they can do in addressing specific issues. Laboratory directors must continue to examine the relevance of research programs to public and private sector needs within the intent of Public Law 96-480. Secondly, R&D centers should revise their directory statements to be more responsive to the public and private constituency identified in the legislation.

4. Coordination With Other Federal Agencies

Coordination is vital to the success of technology transfer. On the one hand, the client groups (States, localities, business) for an expanded Federal laboratory role are diverse and are not aggregated. It will take extra effort on a Federal agency's part to continue reaching these users. Uncoordinated marketing of technology by laboratories, if attempted, could be counterproductive. The users could become disillusioned quickly in trying to deal individually with a multitude of laboratories. To continue to close the gap between knowledge being produced and needs in the public and private sectors, USDA must seek to strengthen the coordination between its research institutions and user needs that are emerging.

Even before the passage of Public Law 96-480, a high level of technology transfer was occurring within the Department. Approximately 1,000 persons visited each of our 9 largest Federal laboratories last year. Since 1975, our Federal laboratory complex has published approximately 3,600 scientific papers per year in professional journals. Popularized versions of research results leading to technology improvement are being published by the Department and land-grant colleges and extension services. It has been estimated that the number of publications distributed through this system is about 5.5 million per year.

Additionally, in recognition of a scientist's work toward application of research findings, we have approved changes in the Agriculture Research Grade Evaluation Guide so that our scientists receive credit for technology transfer efforts.

Obviously, the technological information handled by the Department is substantial. We are improving the effectiveness of the system by increasing reliance on high technology developments in the electronics field.

Technology transfer is necessary, but it is only the first step leading to industrial innovation and increased productivity. Good research is of little value if the results cannot be translated into necessary and useable goods and services.

It is the Department's position that technology transfer in agriculture has been effective and will continue to be effective. By focusing on the use of the latest technology of electronic communications and other conventional techniques, including the possible location by region of extension specialists, our ability to maintain a flow of information to both our traditional and new clients will be improved.

Mr. Chairman, this completes my prepared statement. I will be pleased to answer any questions you and your Committee may have.

Mr. WALGREN. Thank you very much, Dr. Bertrand.

As I am sure you know, the agricultural side was one of the motivators for the committee in past years to try to bring about the same kinds of transfer that had been evident in that area to other parts of our economy. I guess it is pretty obvious that in the agricultural area, there are less barriers in that the end users don't have a proprietary interest if they are small farmers. If you have a new technique, it would seem that all farmers would want to use it and none would feel abused if someone else were using it. So, I guess there is a more ready absorption on the user's end. Is that kind of institutional difference the basic reason for the progress in agriculture that we have not had in other ways?

Dr. BERTRAND. Mr. Chairman, I feel that is certainly a contributing factor and that the programs at the Department of Agriculture, as you have stated, have been responsive to all agricultural producers alike. The proprietary concerns are not as great as they are in industry.

Mr. WALGREN. I see. Well, OK. I understand you have a time problem. We certainly would welcome Mr. Maher joining us when you leave. We may have some written questions to send you after the hearings.

Thank you very much.

Dr. BERTRAND. Thank you.

Mr. WALGREN. Ms. Joseph?

Ms. JOSEPH. Mr. Chairman, I am pleased to appear before you to discuss the Department of Energy's efforts to implement section 11 of the Stevenson-Wydler Technology Innovation Act. Technology transfer activities are not new to the Department, and it has long been recognized that technology transfer was an appropriate function for the Department of Energy laboratories. Within the constraints of available resources and without jeopardizing achieving their mainline missions, our laboratories have engaged and are engaging in technology transfer activities. I have appended to my testimony a number of illustrative examples in this regard. A major benefit of the Stevenson-Wydler Act is, of course, that it provides explicit sanction and authority to departments to continue to carry out such activities. And, in my view, it will assist the institutionalization of the technology transfer process at the Federal laboratories, thereby resulting in improvements in effectiveness.

The Department's field establishment includes over 40 research and development laboratories of widely varying size and complexity of purpose. Of those, 24 are over the $20 million threshold. Of these, nine are Government owned and staffed by Federal employees. The remaining laboratories are Government owned but operated for the Department by private contractors. The laboratories are charged with varying missions. A few are dedicated to single-purpose programs.

Twelve laboratories, identified in an attachment to my testimony, are known as major multi-program laboratories in recognition that their activities are much more broadly based than those of other laboratories. These 12 undertake research that cuts across many disciplines and provides technology base support for a broad range of the Department's missions.

It is these 12 laboratories that will be the focus of our attention when increasing and improving our technology transfer efforts. The Department is in the process of developing flexible guidelines through implementation of the Stevenson-Wydler Technology Innovation Act. In general, we would expect these guidelines to encompass the following elements: Each major multi-program laboratory with an annual budget exceeding $20 million shall establish an Office of Research and Technology Applications [ORTA] staffed by at least one full-time professional; each single-purpose laboratory with an annual budget exceeding $20 million may establish an ORTA if there are sufficient technology transfer opportunities available within the laboratory activities. We will request that the ORTA be funded from laboratory overhead.

The laboratory shall determine which R. & D. programs have potential application in State and local governments and the private sector, and prepare appropriate applications assessments.

The laboratory shall propose an annual 5-year technology transfer plan showing level of effort and scope of activities. The planned ORTA summary shall be incorporated in the laboratory's annual institutional plan for approval by the Department.

We are in the process of obtaining a more precise assessment of current and projected levels of funding for technology transfer activities. Until then, I wish to assure the committee that we are actively committed to a sincere effort toward implementing the act. Indeed, taking into consideration a number of significant activities in progress, we believe we are already well along toward meeting both the spirit and the intent of the act.

My prepared testimony contains examples of DOE laboratory technology transfer activities and I don't plan to go into them now. I would like to point out that eight of the Department's laboratories are members of the Federal Laboratory Consortium [FLC]. In fact, this year's consortium chairman and the current regional coordinator for the west coast are DOE laboratory scientists.

As you know, a showcase for technology conference will be held in Albuquerque, cosponsored by Senator Schmitt, the FLC, the

Department of Energy, Sandia Laboratories, and the Los Alamos National Laboratory. This will be held on October 28 through 30.

In conclusion, I believe it is worth observing that in a very real sense, the energy mission of the Department is technology transfer. The success of the Department's long-term, high-risk energy research and development programs will be measured, in large part, by the extent to which this federally sponsored technology is transferred to and utilized by the private sector. Our energy technology development programs are designed with this in mind.

Mr. Chairman, that concludes my comments and I will be glad to answer any questions you may have.

[The prepared statement of Ms. Joseph follows:]

STATEMENT OF ANTIONETTE GRAYSON JOSEPH
ASSOCIATE DIRECTOR FOR FIELD OPERATIONS MANAGEMENT
DEPARTMENT OF ENERGY
BEFORE THE
SCIENCE, RESEARCH AND TECHNOLOGY SUBCOMMITTEE
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE
JULY 16, 1981

STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980

Mr. Chairman and members of the Subcommittee, I am pleased to appear before you to discuss the Department of Energy's efforts toward implementing Section 11 of the Stevenson-Wydler Technology Innovation Act. Technology transfer activities are not new to the Department or its predecessor agencies, nor to the laboratories within the Department's purview. It has long been recognized that our laboratory complex was established with public funds and that to the extent technology transfer contributes to the public good through assistance to State and local governments and the private sector, it was an appropriate function for the laboratories. Within the constraints of available resources and without jeopardizing achieving their mainline missions, most of the Department's laboratories have engaged in technology transfer activities to some degree. I have appended to my testimony a number of illustrative examples in this regard. A major benefit of the Stevenson-Wydler Technology Innovation Act is, of course, that it provides explicit sanction and authority to departments to continue to carry out such activities.

In designing our approach toward implementing the Stevenson-Wydler Technology Innovation Act, we felt it was essential that we take into consideration both the similarities and differences among our laboratories as well as their individual, unique characteristics. We wished, on the one hand, to provide clear guidance to the laboratory complex as a whole and, on the other, to allow sufficient flexibility to each laboratory to conduct the technology transfer function most effectively in light of its own character, missions and organization. Our approach can be better understood, therefore, if I first spend a few minutes describing our laboratory complex.

The Department's field establishment includes 41 research and development laboratories of widely varying size and complexity of purpose. Of these, nine are government owned and staffed by Federal employees. The remaining laboratories are government owned but operated for the Department by private contractors. Among the latter group, some are operated by a single university, others by a consortia of universities and still others by industrial organizations. The laboratories are charged with varying missions. A few are dedicated to single-purpose programs. Fermilab in Illinois, for example, is devoted almost exclusively to research in high energy and nuclear physics in cooperation with the university community. Twelve laboratories, identified in an attachment to my testimony, are known as major multiprogram laboratories in recognition that their activities are much more broadly based than those of other laboratories. These 12 undertake research that cuts across many disciplines and provides technology base support for a broad range of the Department's missions. Each, however, has special capabilities, expertise and facilities which leads it to emphasize a limited number of technology areas. Four of the multiprogram laboratories, for example, have a primary dedication to nuclear weapons research, development and testing. Each, however, also devotes some of its resources to various aspects of energy technology development.

It will be evident, I believe, that with such a diversity of laboratory missions, organization and management structure, care needs to be taken that we do not inadvertently hamstring the technology transfer function with overly detailed or rigid implementation guidelines. Accordingly, the Department is in the process of developing flexible guidelines toward implementation of the Stevenson-Wydler Technology Innovation Act. In general, we would expect these guidelines to encompass the following elements:

- Each major multiprogram laboratory with an annual budget exceeding $20 million shall establish an Office of Research and Technology Applications (ORTA) staffed by at least one full-time professional. Laboratories having existing organizational structures which perform the functions prescribed for the ORTA may elect to combine the ORTA within the existing organization.

- Each single purpose laboratory with an annual budget exceeding $20 million may establish an ORTA if there are sufficient technology transfer opportunities available within the laboratory activities.

- The ORTA shall be funded from laboratory overhead.

- The ORTA shall be organizationally placed so as to have laboratory-wide support and effective access to all program activities.

- The laboratory shall determine which R&D projects have potential application in State and local governments and the private sector, and prepare appropriate "applications assessments."

- The laboratory shall propose an annual 5-year technology transfer plan showing level of effort and scope of activities. The plan or a summary shall be incorporated in the laboratory's annual institutional plan for approval by the Department.

- The laboratory shall prepare an annual report describing significant technology transfer achievements by fiscal year.

In the process of reviewing the 5-year technology transfer plans to which I just referred, we will obtain a more precise assessment of current and projected levels of funding for technology transfer activities. Until then, I wish to assure the Subcommittee that we are actively committed to a sincere effort toward implementation of the Stevenson-Wydler Technology Innovation Act. Indeed, taking into consideration a number of significant activities in progress, we believe we are already well along toward meeting the spirit and intent of the Act. For example, the Department provides technical information services, primarily through the Technical Information Center, which is a central distribution point for Department-sponsored research reports. The Center also provides short technical notes or technology briefs, known as "energy grams" designed to inform others of advancements stemming from Department-sponsored research. While technical information dissemination is just a component of the technology transfer function, nevertheless it is an essential one and the Department has budgeted $13 million at the Center in FY 1981 to ensure that its research and development results are properly organized and available for efficient access.

Another essential component of technology transfer is one-on-one assistance to those who can make productive use of Federal technology for their own purposes. I would like to cite an outstanding example of this underway at our Lawrence Livermore National Laboratory. The Laboratory has developed a technology training program (TTP) designed to transfer technological innovations and unique expertise developed at the Laboratory to training organizations and trainers for subsequent education of end users. The process consists of appropriately packaging information in an easily-learned, scientifically-developed format, through the use of video tapes and associated printed materials. TTP packages have been developed for innovations such as use of microcomputers and microprocessors, bonding of materials and graphical design techniques. TTP has been very well received by industry and academia. The Society of Mechanical Engineers is promoting the program and distribution of the video tapes and workbooks. Over 100 institutions of higher learning have incorporated TTP packages into their offerings. TTP is funded at $550,000 in FY 1981.

I should also point out that the Lawrence Livermore National Laboratory, as well as seven other Department laboratories, are members of the Federal Laboratory Consortium. In fact, this year's Consortium Chairman and the current Regional Coordinator for the West Coast are DOE laboratory scientists.

Finally, I believe it is worth observing that in a very real sense the energy mission of the Department is technology transfer. The success of the Department's energy research and development programs will be measured, in part, by the extent to which this federally-sponsored technology is transferred to and utilized by the private sector. Our energy technology development programs are designed with this in mind.

That concludes my formal testimony. I will be glad to answer any questions you may have.

ILLUSTRATIVE EXAMPLES OF TECHNOLOGY TRANSFER TO INDUSTRY AND ASSISTANCE TO STATE AND LOCAL GOVERNMENTS BY DOE LABORATORIES

I. Background

The Department's laboratories have a 35-year history of successfully transferring processes and technologies from the laboratories where they were developed to the private sector. This experience provides a strong foundation for their effective implementation of the Stevenson-Wydler Technology Innovation Act.

One of the earliest examples of such technology transfer was in the manufacture and sale of radioactive isotopes used in research, medicine, agriculture and industry. At one time, the Agency's laboratories had the sole capability in the United States for the manufacture of approximately 100 radioisotopes, their conversion into useful chemical forms and their sale to thousands of users throughout the United States and abroad. The radioisotope production and distribution program was designed from its inception with the objective of transferring this function to the private sector. Following passage of legislative authority in 1954 for the private ownership of nuclear reactors, efforts were accelerated toward encouraging private enterprise participation in radioisotope production and distribution through a variety of technical information dissemination, training, contracting, regulatory and incentive techniques. By the late 1960s, the manufacture, chemical conversion and sale of most of the 100 radioisotopes had been established as an independent competitive private industry.

A more difficult, but equally successful example of technology transfer was the creation of the light water reactor (LWR) power industry. At the outset, development of this technology and industry was beset by a host of constraints, the foremost of which were an embryonic base of scientific knowledge, a dearth of appropriately trained scientists and engineers, the lack of a suitable industrial research and development infrastructure, concomitant obscure profitability prospects and the existence of strict security classification restrictions. For these reasons, development of LWR technology of necessity was undertaken initially within the Agency's laboratory complex. Nevertheless, planning of the program incorporated measures looking toward and facilitating ultimate commercial manufacture and use of LWRs. These took a variety of forms: fellowships at universities, training courses for already practicing scientists and engineers, awarding of contracts to industry wherever feasible, providing opporunity for industrial personnel to work for periods of time at the laboratories side-by-side with laboratory staff, recognizing and accepting that laboratory staffs were a source of manpower for recruitment by the private sector and providing legislative encouragements. Technology transfer was accomplished and a private industry does exist.

The foregoing are but two examples of numerous instances of successful technology transfer by the laboratories. The experiences gained and lessons learned are already being applied to today's problems and opportunities, as indicated in the following two sections, and will be invaluable as the laboratories gear up for implementation of the Stevenson-Wydler Technology Innovation Act.

II. Technology Transfer to Industry

- Developed the only available process for the separation of rare earth elements. Process has been commercially adopted. Rare earths used as catalysts yield 14 percent more gasoline from crude oil. In other uses, they cut clinical X-ray exposure time in half, brighten television screens and control auto emissions. (Ames)
- Developed solid state ballasts for fluorescent light fixtures that reduce electricity consumption by 35 percent. Four companies are building production facilities to manufacture the device. The market is estimated at $200 million annually. (LBL)
- Developed semiconductor technology in connection with high energy physics experiments that is now being used in medical diagnostic arrays, photodiodes, infrared light detectors, oil well logging, radioactive dating and scanning electronmicroscopy. Six companies are marketing such systems. Sales are over $200 million a year. (LBL)
- Identified clinical X-ray and radiography techniques in the course of building a new accelerator which found application in clinical medicine. The equipment is being produced by three companies. By 1979, they had sold 350 pieces valued at over $50 million. (LANSL)

- Developed centrifuge rotors that greatly increase the removal of impurities from flu vaccine, making its use more practical. Device is produced by three companies whose cumulative sales since 1971 total $10 million. (ORNL)
- Developed decontamination methods and techniques including a mobile electropolishing unit. Using these techniques, four companies are offering metal surface cleaning services to utilities throughout the country. (PNL)

III. Assistance to State and Local Governments

- Development of atomic emission and mass spectroscopy techniques which are widely used by State and local governments and industry for trace metal analysis of both air and water. (Ames)
- Assistance to six States in land reclamation at abandoned surface coal mine sites. (ANL)
- Assistance to the New York State Department of Transportation, Sulfolk County Highway Department and Brookhaven Town Highway Department in using concrete polymer developed at BNL on highway and bridge repairs. (BNL)
- Provision of technical advice and demonstration to the city of Berkeley, the California Energy Commission and Oregon State Homebuilders Association with regard to building energy conservation. (LBL)

- Assistance to several States through satellite mapping of strip mining areas to assess compliance with the Surface Mining Act. (ORNL)
- Assistance to the city of Minneapolis-St. Paul by conducting a study of heat/electricity cogeneration. (ORNL)

DOE MAJOR MULTIPROGRAM LABORATORIES

Laboratory	City & State
Ames Laboratory	Ames, Iowa
Argonne National Laboratory	Argonne, Illinois
Brookhaven National Laboratory	Upton, Long Island, New York
Hanford Engineering Development Laboratory	Richland, Washington
Idaho National Engineering Laboratory	Idaho Falls, Idaho
Lawrence Berkeley Laboratory	Berkeley, California
Lawrence Livermore National Laboratory	Livermore, California
Los Alamos National Scientific Laboratory	Los Alamos, New Mexico
Oak Ridge National Laboratory	Oak Ridge, Tennessee
Pacific Northwest Laboratory	Richland, Washington
Sandia National Laboratories	Albuquerque, New Mexico
Savannah River Laboratory	Aiken, South Carolina

Mr. **Walgren**. Thank you very much.

Is it true that the act would require an office in every Federal laboratory? Is that your impression?

Ms. **Joseph**. It would require an ORTA. Whether it has to be a separate office or not, I am not sure. What we would assure is that there would be an ORTA function within the director's office of each of the major laboratories, and the laboratories would be informed that they will be carrying out the activities required by the act. I think the act permits us some flexibility as to whether or not a separate office is set up. I believe in some cases we can include it within ongoing activities without setting up a separate office. For the major laboratories, we would plan to require that a full-time employee be designated as head of a separate ORTA.

Mr. **Walgren**. We appreciate that statement of DOE's position and we may be in contact with you about it.

Ms. **Joseph**. We will accomplish the objectives you are seeking in this regard, and we will try to insure that we don't unnecessarily increase the existing bureaucracy. I believe in many cases we can effectively utilize the process and structure that exists and carry out all of the intentions of the act.

Mr. **Walgren**. Those laboratories in excess of $20 million will have a——

Ms. **Joseph**. They will have an ORTA.

Mr. **Walgren**. And that will be an office and that will be at least a full-time person, is that correct?

Ms. **Joseph**. We may request an exception to the one full-time person at every office where there isn't enough activity to merit one and where you would agree that there isn't.

There are some laboratories where I think it would be more efficient not to require a full-time person. In these cases we would insure that we have people who have written in their job descriptions responsibility for ORTA functions.

However, in terms of the 12 major multi-program laboratories, we would require a full-time person, as well as for many of the other laboratories that have budgets of over $20 million.

Mr. **Walgren**. What is our timeframe in this, in your planning?

Ms. **Joseph**. It would be before September probably.

Mr. **Walgren**. So you could append or submit to the committee a detailed list of your laboratories and where you feel that you would best not have a full-time person?

Ms. **Joseph**. We will do that.

[The material follows:]

CURRENT/PLANNED TECHNOLOGY TRANSFER STAFFING AT DOE R&D LABORATORIES

Laboratory	FY 1981 DOE Budget (millions)	At Least 1 Full-time Professional Yes	No
Ames Laboratory	$20.0	X	
Argonne National Laboratory	320.2	X	
Brookhaven National Laboratory	216.4	X	
Hanford Engineering Development Laboratory	145.5	X	
Idaho National Engineering Laboratory	316.0	X	
Lawrence Berkeley Laboratory	139.1	X	
Lawrence Livermore National Laboratory	586.1	X	
Los Alamos National Laboratory	489.9	X	
Oak Ridge National Laboratory	435.5	X	
Pacific Northwest Laboratory	146.1	X	
Sandia National Laboratories	663.6	X	
Savannah River Laboratory	78.7	X	
Energy Technology Engineering Center	32.3	X	
Solar Energy Research Institute	138.5	X	
Bartlesville Energy Technology Center	29.1	X	
Pittsburgh Energy Technology Center (includes: Carbondale Mining Technology Center and Pittsburgh Mining Technology Center)	137.4	X	
Grand Forks Energy Technology Center	9.1		X
Laramie Energy Technology Center*	46.7		X
Morgantown Energy Technology Center*	89.6		X
Center for Energy and Environment Research	2.6		X
Comparative Animal Research Laboratory	1.5		X

	FY 1981 DOE Budget (millions)	At Least 1 Full-time Professional	
		Yes	No
Environmental Measurements Laboratory	5.9		X
Inhalation Toxicology Research Institute	8.0		X
Laboratory for Energy-Related Health Research	3.9		X
Laboratory for Nuclear Medicine and Radiation Biology	4.0		X
Laboratory of Radiobiology (University of California)	2.1		X
MSU-DOE Plant Research Laboratory	1.5		X
Oak Ridge Associated Universities	12.3		X
Radiobiology Laboratory (University of Utah)	1.9		X
Savannah River Ecology Laboratory	1.9		X
University of Rochester Biomedical Laboratory	2.4		X
Princeton Plasma Physics Laboratory*	135.9		X
Bettis Atomic Power Laboratory*	203.4		X
Knolls Atomic Power Laboratory*	190.1		X
Bates Linear Accelerator Facility	8.3		X
Fermi National Accelerator Laboratory*	121.6		X
Notre Dame Radiation Laboratory	2.5		X
Stanford Linear Accelerator Center*	64.0		X
New Brunswick Laboratory	2.3		X

* The five fossil energy laboratories (Bartlesville, Pittsburgh, Grand Forks, Laramie and Morgantown) represent special situations in that technology transfer is an intrinsic part of their mission. Each has organized its technology transfer activities in a manner commensurate with its particular mission and constituencies. Thus, Pittsburgh, and Bartlesville in fact have a specific organizational unit devoted to technology transfer staffed with one or more full-time professionals. Laramie and Morgantown, on the other hand, find that assigning technology transfer throughout their

organizational components is more effective in their particular circumstances. Regardless, all of these laboratories fully meet the intent of P.L. 96-480. It is judged that to require Laramie and Morgantown to meet the precise provisions of the Act would likely result in reduced technology transfer effectiveness.

Bettis and Knolls perform research and development on naval nuclear propulsion plants and associated reactor cores to meet military requirements of the Navy. Princeton's mission is to conduct plasma physics research and pursue work on controlled thermonuclear fusion. Fermi and SLAC are concerned with research into elementary particle and high energy physics. All of these laboratories are engaged in highly specialized, often esoteric, research which, by its very nature, would be expected to offer minimal opportunities for technology transfer, especially with regard to State and local governments. It is judged that to require each of these laboratories to meet the precise provisions of the Act would be inefficient and cost ineffective. Instead, each laboratory director will be expected to designate a member of his immediate staff to assess and pursue technology transfer opportunities as they arise.

Mr. **WALGREN**. The subcommittee will look forward to it.

Thank you very much. We appreciate your being here and the opportunity to get to know you and follow up on the problem with you.

Mr. Linhares?

Mr. **LINHARES**. Thank you, Mr. Chairman. I appreciate the opportunity to appear before the subcommittee to discuss the Department of Transportation's technology transfer activities, the role of the Department's laboratories in intergovernmental technology transfer, and DOT's activities to comply with the Stevenson-Wydler Technology Innovation Act of 1980.

Our Department feels that effective support of State and local governments is especially critical these days, considering the ongoing reassessment of governmental roles, and the financial pressures facing all levels of government. This view is shared throughout the Department, including the Secretary and his policy officials. Assistant Secretary for Governmental Affairs, Lee Verstandig, in whose office I work, is a particularly active proponent of this position, and in fact recently issued a statement to the Department's operating administrations asking them to explore how technical assistance or technology transfer activities might help State and local officials deal with reduced funding from the Federal level.

For some time now, the Department of Transportation has been active in the technology sharing or transfer process.

As a civil sector agency, we consider State and local governments a primary constituency for our research and development programs, and the needs of these jurisdictions is now a major consideration in our R. & D. program formulation. This is only logical, since State and local governments are responsible for implementing a large number of transportation improvements in this country.

To put this in perspective, our research and development budget in fiscal year 1981 was about $378 million and has averaged near that level for several years. It is estimated that up to 50 percent of the Department's R. & D. funds are spent on products for which State and local governments are or can be the ultimate users.

The Department's laboratories are an important component of this process, both in terms of developing the technologies and disseminating them to ultimate users. The Department has eight facilities which can be classified as laboratories or technical centers. From a technology transfer standpoint, I think it important to note that four of these facilities have been long standing, active members of the Federal Laboratory Consortium.

One, the Research and Special Program Administration's Transportation Systems Center located in Cambridge, Mass.; two, the Federal Highway Administration's Fairbanks Highway Research Center, located in the Virginia suburbs of Washington; three, the Federal Aviation Administration's Technical Center, located in Atlantic City, N.J.; and four, the U.S. Coast Guard Research and Development Center, located in Groton, Conn.

Our long-time participation in the Consortium reflects our recognition that the Federal laboratories do have an important role to play in responding directly to the needs of State and local governments. Thus, we view the Stevenson-Wydler Act provisions as a focusing of many of our activities, rather than a call for large-scale initiation of new projects.

At the Transportation Systems Center in Cambridge, for example, there is an Office of Technology Sharing which is responsible for technology transfer activities with State and local governments and the private sector. We will incorporate within this office any additional functions specified under section 11(c) of the act within the October 1, 1981 timeframe.

Also, the Federal Highway Administration has traditionally worked closely with State and local governments to assist in their transportation needs. The Fairbanks Research Laboratory is one element of an extensive network of technology transfer mechanisms run by the Federal Highway Administration, including a division office in each State which has a full-time technology transfer coordinator.

Technology transfer, per se, is required by language contained in the Department of Transportation Act. My Office of Technology Sharing, in the Office of the Secretary, was created to serve as a focal point for the modal administration technology transfer activities.

We have encouraged the laboratories to participate in the activities of the Federal Laboratory Consortium, and their management has been responsive to, and supportive of, such participation. We would hope to make continuing use of this channel in the future.

In my office, we support and supplement the technology transfer activities of the various Department of Transportation administrations, and in particular make sure that technical materials find their way to State and local elected officials.

By the way, technology as we define it and the laboratories interpret it, broadly includes hardware, software, operational improvements, and management techniques.

I view the next few years as a particular challenge, for they will require some rethinking of the way we approach State and local officials, and the entire technology transfer processes.

We are reviewing our activities and approaches to increase our outreach without any increase in additional resources. For example, we are working closely with the Office of Intergovernmental Affairs, another office under the Assistant Secretary for Governmental Affairs. This office has responsibility for working with and responding to the needs of State and local governments on various general and specific issues.

By using that office's extensive contacts and knowledge, we can better target and disseminate our technology sharing products and processes.

I would also hope that networks like the Laboratory Consortium continue, for they strongly contribute to the most productive use of all the available resources by the widest variety of parties. One of the biggest questions which we look forward to addressing is how line researchers will react to the closer working relationships that will be necessary with the consumers of their research.

There will also be the need for earlier consideration of the newly developed technologies, and for more creativity in developing spinoffs from existing ones. Undoubtedly this will not be easy, but we in the Department have confidence that it can be done.

Also, although my remarks have primarily pertained to our activities with the State and local governments, our technology sharing efforts are very relevant to the private sector. In fact, we view private sector involvement as perhaps the most important aspect in the future.

In summary, technology transfer or sharing is an inherent and important function within the Department of Transportation, and the laboratories of the Department are an inherent part of the function.

We feel our overall program meets the intent and requirements of the Stevenson-Wydler Technology Innovation Act of 1980.

Thank you. I will be glad to answer any questions you may have.

[The prepared statement of Mr. Linhares follows:]

STATEMENT OF
ALFONSO B. LINHARES
DIRECTOR, OFFICE OF TECHNOLOGY SHARING
U.S. DEPARTMENT OF TRANSPORTATION
BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
OF THE
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
JULY 16, 1981

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I APPRECIATE THE OPPORTUNITY TO APPEAR BEFORE THIS SUBCOMMITTEE TO DISCUSS THE DEPARTMENT OF TRANSPORTATION'S TECHNOLOGY TRANSFER ACTIVITIES, THE ROLE OF THE DEPARTMENT'S LABS IN INTERGOVERNMENTAL TECHNOLOGY TRANSFER, AND DOT'S ACTIVITIES TO COMPLY WITH THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (PL 96-480).

OUR DEPARTMENT FEELS THAT EFFECTIVE SUPPORT OF STATE AND LOCAL GOVERNMENTS IS ESPECIALLY CRITICAL THESE DAYS, CONSIDERING THE ONGOING REASSESSMENT OF GOVERNMENTAL ROLES, AND THE FINANCIAL PRESSURES FACING ALL LEVELS OF GOVERNMENT. THIS VIEW IS SHARED THROUGHOUT THE DEPARTMENT, INCLUDING THE SECRETARY AND HIS POLICY OFFICIALS. ASSISTANT SECRETARY FOR GOVERNMENTAL AFFAIRS LEE VERSTANDIG, IN WHOSE OFFICE I WORK, IS A PARTICULARLY ACTIVE PROPONENT OF THIS POSITION, AND IN FACT RECENTLY ISSUED A STATEMENT TO THE DEPARTMENT'S OPERATING ADMINISTRATIONS ASKING THEM TO EXPLORE HOW TECHNICAL ASSISTANCE OR TECHNOLOGY TRANSFER ACTIVITIES MIGHT HELP STATE AND LOCAL OFFICIALS DEAL WITH REDUCED FUNDING FROM THE FEDERAL LEVEL.

FOR SOME TIME NOW, THE DEPARTMENT OF TRANSPORTATION HAS BEEN ACTIVE IN THE TECHNOLOGY SHARING OR TRANSFER PROCESS. AS A CIVIL SECTOR AGENCY, WE CONSIDER STATE AND LOCAL GOVERNMENTS A PRIMARY CONSTITUENCY FOR OUR RESEARCH AND DEVELOPMENT (R&D) PROGRAMS, AND THE NEEDS OF THESE JURISDICTIONS IS NOW A MAJOR CONSIDERATION IN OUR R&D PROGRAM FORMULATION. THIS IS ONLY LOGICAL, SINCE STATE AND LOCAL GOVERNMENTS ARE RESPONSIBLE FOR IMPLEMENTING A LARGE NUMBER OF TRANSPORTATION IMPROVEMENTS IN THIS COUNTRY. TO PUT THIS IN PERSPECTIVE, OUR RESEARCH AND DEVELOPMENT BUDGET IN FY 1981 WAS ABOUT $378 MILLION AND HAS AVERAGED NEAR THAT LEVEL FOR SEVERAL YEARS. IT IS ESTIMATED THAT UP TO FIFTY PERCENT OF THE DEPARTMENT'S R&D FUNDS ARE SPENT ON PRODUCTS FOR WHICH STATE AND LOCAL GOVERNMENTS ARE OR CAN BE THE ULTIMATE USERS.

THE DEPARTMENT'S LABORATORIES ARE AN IMPORTANT COMPONENT OF THIS PROCESS, BOTH IN TERMS OF DEVELOPING THE TECHNOLOGIES AND DISSEMINATING THEM TO ULTIMATE USERS. THE DEPARTMENT HAS EIGHT FACILITIES WHICH CAN BE CLASSIFIED AS LABORATORIES OR TECHNICAL CENTERS. FROM A TECHNOLOGY TRANSFER STANDPOINT, I THINK IT IMPORTANT TO NOTE THAT FOUR OF THESE FACILITIES HAVE BEEN LONG-STANDING, ACTIVE MEMBERS OF THE FEDERAL LABORATORY CONSORTIUM:

1. THE RESEARCH AND SPECIAL PROGRAM ADMINISTRATION'S TRANSPORTATION SYSTEMS CENTER, LOCATED IN CAMBRIDGE, MASSACHUSETTS,

2. THE FEDERAL HIGHWAY ADMINISTRATION'S FAIRBANKS HIGHWAY RESEARCH CENTER, LOCATED IN THE VIRGINIA SUBURBS OF WASHINGTON,
3. THE FEDERAL AVIATION ADMINISTRATION'S TECHNICAL CENTER, LOCATED IN ATLANTIC CITY, NEW JERSEY, AND
4. THE U. S. COAST GUARD RESEARCH AND DEVELOPMENT CENTER, LOCATED IN GROTON, CONNECTICUT.

OUR LONG-TIME PARTICIPATION IN THE CONSORTIUM REFLECTS OUR RECOGNITION THAT THE FEDERAL LABORATORIES DO HAVE AN IMPORTANT ROLE TO PLAY IN RESPONDING DIRECTLY TO THE NEEDS OF STATE AND LOCAL GOVERNMENTS. THUS, WE VIEW THE STEVENSON-WYDLER ACT PROVISIONS AS A FOCUSING OF MANY OF OUR ACTIVITIES, RATHER THAN A CALL FOR LARGE-SCALE INITIATION OF NEW PROJECTS.

AT THE TRANSPORTATION SYSTEMS CENTER IN CAMBRIDGE, FOR EXAMPLE, THERE IS AN OFFICE OF TECHNOLOGY SHARING WHICH IS RESPONSIBLE FOR TECHNOLOGY TRANSFER ACTIVITIES WITH STATE AND LOCAL GOVERNMENTS AND THE PRIVATE SECTOR. WE WILL INCORPORATE WITHIN THIS OFFICE ANY ADDITIONAL FUNCTIONS SPECIFIED UNDER SECTION 11(C) OF THE ACT WITHIN THE OCTOBER 1, 1981 TIMEFRAME.

ALSO, THE FEDERAL HIGHWAY ADMINISTRATION HAS TRADITIONALLY WORKED CLOSELY WITH STATE AND LOCAL GOVERNMENTS TO ASSIST IN THEIR TRANSPORTATION NEEDS. THE FAIRBANKS RESEARCH LAB IS ONE ELEMENT OF AN EXTENSIVE NETWORK OF TECHNOLOGY TRANSFER MECHANISMS

RUN BY THE FEDERAL HIGHWAY ADMINISTRATION, INCLUDING A "DIVISION OFFICE" IN EACH STATE WHICH HAS A FULL-TIME TECHNOLOGY TRANSFER COORDINATOR.

TECHNOLOGY TRANSFER, PER SE, IS REQUIRED BY LANGUAGE CONTAINED IN THE DEPARTMENT OF TRANSPORTATION ACT. MY OFFICE OF TECHNOLOGY SHARING, IN THE OFFICE OF THE SECRETARY, WAS CREATED TO SERVE AS A FOCAL POINT FOR THE MODAL ADMINISTRATION TECHNOLOGY TRANSFER ACTIVITIES. WE HAVE ENCOURAGED THE LABS TO PARTICIPATE IN THE ACTIVITIES OF THE FEDERAL LABORATORY CONSORTIUM, AND THEIR MANAGEMENT HAS BEEN RESPONSIVE TO, AND SUPPORTIVE OF, SUCH PARTICIPATION. WE WOULD HOPE TO MAKE CONTINUING USE OF THIS CHANNEL IN THE FUTURE.

IN MY OFFICE, WE SUPPORT AND SUPPLEMENT THE TECHNOLOGY TRANSFER ACTIVITIES OF THE VARIOUS DEPARTMENT OF TRANSPORTATION ADMINISTRATIONS, AND IN PARTICULAR MAKE SURE THAT TECHNICAL MATERIALS FIND THEIR WAY TO STATE AND LOCAL ELECTED OFFICIALS. TECHNOLOGY, AS WE DEFINE IT AND THE LABORATORIES INTERPRET IT, BROADLY INCLUDES HARDWARE SOFTWARE, OPERATIONAL IMPROVEMENTS, AND MANAGEMENT TECHNIQUES.

I VIEW THE NEXT FEW YEARS AS A PARTICULAR CHALLENGE, FOR THEY WILL REQUIRE SOME RETHINKING OF THE WAY WE APPROACH STATE AND LOCAL OFFICIALS, AND THE ENTIRE TECHNOLOGY TRANSFER PROCESS.

WE ARE REVIEWING OUR ACTIVITIES AND APPROACHES TO INCREASE OUR OUTREACH WITHOUT ANY INCREASE IN ADDITIONAL RESOURCES. FOR EXAMPLE, WE ARE WORKING CLOSELY WITH THE OFFICE OF INTERGOVERNMENTAL AFFAIRS, ANOTHER OFFICE UNDER THE ASSISTANT SECRETARY FOR GOVERNMENTAL AFFAIRS. THE INTERGOVERNMENTAL AFFAIRS OFFICE HAS RESPONSIBILITY FOR WORKING WITH AND RESPONDING TO THE NEEDS OF STATE AND LOCAL GOVERNMENTS ON VARIOUS GENERAL AND SPECIFIC ISSUES. BY USING THAT OFFICE'S EXTENSIVE CONTACTS AND KNOWLEDGE, WE CAN BETTER TARGET AND DISSEMINATE OUR TECHNOLOGY SHARING PRODUCTS AND PROCESSES.

I WOULD ALSO HOPE THAT NETWORKS LIKE THE LABORATORY CONSORTIUM CONTINUE, FOR THEY STRONGLY CONTRIBUTE TO THE MOST PRODUCTIVE USE OF ALL THE AVAILABLE RESOURCES BY THE WIDEST VARIETY OF PARTIES. ONE OF THE BIGGEST QUESTIONS WHICH WE LOOK FORWARD TO ADDRESSING IS HOW LINE RESEARCHERS WILL REACT TO THE CLOSER WORKING RELATIONSHIPS THAT WILL BE NECESSARY WITH THE CONSUMERS OF THEIR RESEARCH. THERE WILL ALSO BE THE NEED FOR EARLIER CONSIDERATION OF NEWLY DEVELOPED TECHNOLOGIES, AND FOR MORE CREATIVITY IN DEVELOPING SPIN-OFFS FROM EXISTING ONES. UNDOUBTEDLY, THIS WILL NOT BE EASY, BUT WE IN THE DEPARTMENT ARE CONFIDENT THAT IT CAN BE DONE.

ALSO, ALTHOUGH MY REMARKS HAVE PRIMARILY PERTAINED TO OUR ACTIVITIES WITH STATE AND LOCAL GOVERNMENTS, OUR TECHNOLOGY SHARING EFFORTS ARE VERY RELEVANT TO THE PRIVATE SECTOR. WE VIEW

PRIVATE SECTOR INVOLVEMENT AS PERHAPS THE MOST IMPORTANT ASPECT IN THE FUTURE.

IN SUMMARY, TECHNOLOGY TRANSFER OR SHARING IS AN INHERENT AND IMPORTANT FUNCTION WITHIN THE DEPARTMENT OF TRANSPORTATION; AND THE LABORATORIES OF THE DEPARTMENT ARE AN INHERENT PART OF THE FUNCTION. WE FEEL OUR OVERALL PROGRAM MEETS THE INTENT AND REQUIREMENTS OF THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980.

THANK YOU.

Mr. WALGREN. Thank you very much, Mr. Linhares.

You mentioned four laboratories out of eight.

Mr. LINHARES. Yes.

Mr. WALGREN. Can you tell me whether there is a specific person in each of the eight laboratories or is it just four that you are dealing with now?

Mr. LINHARES. The four I cited are mentioned primarily because they are members of the Federal Laboratory Consortium. The other four, some of which are very small laboratories, do in fact have a lot of technology transfer kinds of activities on-going.

For example, one of them is the Civil Aeromedical Institute in Oklahoma City which has a budget of around $6 million, total. Although that falls below the $20 million level, they actually do a lot of activities which we feel are technology transfer activities. They conduct training sessions for State and local governments and the private sector.

They are very much involved in dissemination of information through, primarily, training techniques. Although we can't identify within that facility, for example, one individual that has been assigned the function, when you look at the total program, it turns out that there is quite a bit of technology sharing going on.

There are other facilities like the Shipboard Fire and Safety Facility, which is the Coast Guard facility in Mobile, Ala., which has a very small staff. It is less than $1 million, by the way.

There, we haven't identified a specific individual. But again, they do a lot of training activities, bringing in State and local governments and the private sector to train them with regard to safety activities. So we do not have a specific individual who has been identified in each of the laboratories, but we do have a lot of functions within each of the laboratories which we feel meet the intent and the spirit of the act.

Mr. WALGREN. So, you have no problem saying that certainly the financial effort that is being called for in the act is being met?

Mr. LINHARES. We far exceed the financial requirements of the act.

Mr. WALGREN. I don't think an argument can be made for a very rigid approach to that. It probably would be helpful if you could submit for the record a list of the eight laboratories, certainly all the ones that DOT considers laboratories in the system, with some idea of their overall budget and their activities, and then identify those in which you have the formal full technology transfer person in—the four. Is that right?

Mr. LINHARES. Yes.

Mr. WALGREN. You meet the structure of the act in those?

Mr. LINHARES. Yes. One of those facilities, the FAA facility in Atlantic City, does a lot of technology transfer of the nature I was talking about, but they are specifically looking into establishing an Office of Technology Transfer as called for in the act.

Mr. WALGREN. We wish that the Congress were all of one mind. It often isn't. I understand the Appropriations Committee had reduced at least a recommendation from the administration for technology transfer as a function.

Mr. LINHARES. Yes sir.

Mr. WALGREN. But that with the Department's endorsement and emphasis on that function, that some of those functions were restored. We have yet to see what the Senate does, is that correct?

Mr. LINHARES. That is correct. I was very heartened as were all the people involved in technology sharing in the Department that, No. 1, the Secretary and our Assistant Secretary did strongly support technology sharing. When the House Appropriations Committee reduced the budget, they personally went to bat to get it increased.

So, we certainly know we have the support within the Department and we are hopeful that with the Senate side that perhaps we will get back even more of the funds that were reduced.

Mr. WALGREN. Do you feel that that kind of uncertainty is going to have any effect on your efforts in technology transfer at this point?

Mr. LINHARES. I am an optimist. It could, but I would hope not. Even if we do get reduced somewhat funding-wise, it turns out that many elements of the Department now are getting on the bandwagon of technology sharing. So I feel that even with a reduction in my budget specifically, that this can hopefully be made up by increased activities in other elements of the Department.

I shouldn't say that, I guess. I guess I should push for an increased budget.

Mr. WALGREN. Well, no. That is certainly the proper way to go about it. The effort will be more effective if it doesn't necessarily represent dollars, and if it represents effort, that is better. You indicated that you are trying to engage in more technical assistance to fill in some of the reductions of effort in the overall transportation budget.

Can you elaborate a little bit on that? What does that specifically involve? What new things are you doing to fill what voids?

Mr. LINHARES. For example, as you know, the operating and capital assistance programs are being reduced budget wise. So this means that less money will be available to State and local governments to implement transportation facilities and improvements.

Well, under such circumstances, although there has already been a great interest in the kind of information that the technology sharing program has put out, there is an increased interest now. For example, specifically information with regard to funding of transportation systems. If the funds are reduced, there is an increased interest in the question, how do I fund my system in my city or State with reduced Federal funding.

There are many techniques being used around the country to bring in increased revenues for funding transportation. That is one example of an area for increased information dissemination. Another is—Seattle, for example, established a part-time bus driver arrangement. It was the first in the country. It turned out to save them substantial resources in terms of operating funds for their transit system. This kind of information is of extreme interest to other transit systems around the country.

We have been in the process of disseminating how Seattle did this so that other jurisdictions might possibly do the same. That is the kind of thing I am talking about. Through better techniques and better technology we might be able to get along even though the funding from the Federal level has been reduced. That is the philosophy which the Secretary and my Assistant Secretary have very firmly emphasized.

Mr. **Walgren**. Thank you very much, Mr. Linhares. Mr. Shamansky?

Mr. **Shamansky**. Thank you, Mr. Chairman.

Has the Department of Transportation established an Office of Research and Technological Applications in each of its Federal laboratories?

Mr. **Linhares**. No, sir. We discussed this previously. We have a number of offices at some of the laboratories. We have an office of technology sharing at the Transportation Systems Center, which has been doing what has been called for under the Stevenson-Wydler Act. We would view that office as being responsible for section 11(c) of the act.

There has been some consideration about changing the name, but that office is so well-known around the country that——

Mr. **Shamansky**. A rose by any other name?

Mr. **Linhares**. Right.

Mr. **Shamansky**. Maybe you touched upon this earlier when I was called out. Is your Department spending at least a half a percent of its R. & D. budget on technology transfer?

Mr. **Linhares**. Yes, sir, we far exceed that when you take into consideration all the programs that may not be called technology transfer, but are in fact technology transfer.

Mr. **Shamansky**. That becomes a matter of definition. You could call things technology transfer and they wouldn't be.

Mr. **Linhares**. Those things that are called technology transfer are very similar. The highway department calls it the implementation division with technology transfer as its primary function. If you take just those activities that are specifically identified as technology transfer functions, we still exceed the requirements of the act by perhaps four times.

If you take into account those activities that we feel are technology transfer related, we are probably talking 10 times the requirement that's called for in the act.

Mr. **Shamansky**. I was intrigued by your reference to Seattle's management, part-time drivers, which has nothing to do with technology, but everything to do with management.

Mr. **Linhares**. In my statement, I stated that we broadly define technology as being associated with hardware, software, management and operational techniques.

Mr. **Shamansky**. I happen to be a lawyer and that's very creative English. I wouldn't have guessed that technology could be a commonsense management thing.

Mr. **Linhares**. There are many studies associated with how you reduce the operating costs of transit systems. So anything that comes out of research and development, we include under technology transfer.

Mr. **Shamansky**. With respect to dissemination of management techniques, is the Department of Transportation the principal source for the dissemination of that kind of information, or does the transportation industry have its own methods of disseminating information?

Mr. **Linhares**. We are not the only source, by any means. For example, the American Public Transit Association is an active disseminator of information with regard to that.

We work with the American Public Transit Association and all the associations that deal with transportation. In fact, we often use their resources as a dissemination mechanism. In other words, they have newsletters, and conferences, and these are all good mechanisms for disseminating information.

Mr. **Shamansky**. That raises the question that maybe you are superfluous if that's what they are doing.

Mr. **Linhares**. Maybe it does raise that question, but from what we found, we are not superfluous because they do come to us for assistance in such things as obtaining information on whatever subject they might be interested in.

Mr. **Shamansky**. Thank you. Thank you, Mr. Chairman.

Mr. **Walgren**. Mr. Watkins, our friend from the Appropriations Committee, who formerly was a member of this committee and has continued that interest, is here to ask a few questions of the panel.

Mr. **Watkins**. Mr. Chairman, I appreciate you very much allowing me to come back and be a part of this.

Mr. **Walgren**. You're more than welcome here.

Mr. **Watkins**. I want to express to Bob and the other members of the committee my deep appreciation. I want to take about two-thirds of my time thanking some people and praising their initiative and their help.

First, Mr. Maher—I think you're taking Mr. Bertrand's place. I wasn't here for his testimony. There is redistricting in Oklahoma, and I was trying to see if I still had a district.

There are some new and innovative ways to redistrict in this country. [Laughter.]

I commend the Department of Agriculture for the work you have done historically and traditionally, not only in dissemination but in getting technology transfer out there in agriculture. As this committee knows, I have used that as a prime example how agriculture, using only 3 percent of the people in this country, can feed this country and nearly one-third of the world. It is because we have had not only dissemination, but technology transferred out there into experimental farms.

It was out there actually being applied. I was one of those as well as other people in this room. You're taking the lead and it's my understanding you're going to work with the U.S. Conference of Mayors in trying to make sure that that information is disseminated and hopefully, applied to a certain extent. Efforts are being made in that way to get technology even outside of agriculture, to small industries and rural communities. I want to commend the U.S. Department of Agriculture for taking this initiative.

Mr. Roberson, NASA is also an agency that has been mandated to do technology transfer. NASA is the only agency outside of the USDA recognizing there is a rural depressed area of this country that can utilize technology and needs technology to help their economic basis.

So, Mr. Roberson, I appreciate your continued support and your great help that way. Those things can make a great deal of difference in the future of places like Appalachia and the Ozarks and that area of rural depressed America.

How can we get the information disseminated if the administration wipes out the technology utilization area of NASA which is only a small amount? Do you have any thoughts on what we might do if that's——

Mr. **Walgren**. Maybe it would be a good time to let Mr. Roberson make whatever statement he'd like. I have been going down the panel sequentially and haven't gotten that far yet.

Mr. **Watkins**. I will pass on that. I would like to just make that question a part of the record. I've got to go to Appropriations because they have Transportation up. [Laughter.]

Mr. **Walgren**. Let's try and respond to that question, then. The general practice is to do the whole panel at once and I didn't do that. I went down sequentially. Please go ahead and respond to Mr. Watkins on that.

Mr. **Watkins**. You are kind, Mr. Chairman. I know it's beyond the call of duty. [Laughter.]

Mr. **Roberson**. That's a difficult question. I think the end result of what is happening to the technology utilization program you referred to is not yet certain. The administration requested a rescission in the fiscal year 1981 budget and the Congress restored a portion of that rescission. So in fiscal year 1981, we are still going strong.

The fiscal year 1982 budget was reduced substantially, but the reduction has not and is not currently intended to close the technology utilization program down. It is planned that the information dissemination and network capability to transfer technology to users will be maintained.

We will have to become more creative in determining how we can get users and people who benefit from the TV to share part of the costs, program and also continue to do other innovative things that we can do within current budget constraints.

The fiscal year 1982 budget is in the Congress now and there seems to be some sentiment for providing additional support for some TV activities.

Mr. **Watkins**. Mr. Chairman, I have some other questions and comments that I will enter for the record.

Mr. Maher, you plan to carry out a pilot program. Will this get into the rural communities?

Mr. Maher. Thank you for the kind remarks on USDA. I can't take any credit for the successes in production agriculture, but we are trying to get work transferred to the communities and to the business sector in the nonagricultural area.

We have before us a proposal that would, under the auspices of the U.S. Conference of Mayors, link USDA research base in the land grant universities and agricultural research in other sectors in USDA with rural communities on problem-solving issues. The connective tissue between the research base, the supply side, and the users would be the extension system in order to make the adaptation of research results fit with the needs of the rural communities.

We saw this as an opportunity to get out of the barn early on this legislation and to exercise the legislation in a pilot way. I think that the effort, Congressman Watkins, in a sense embodies all of the elements that, on a pilot basis, are called for in section 11 of Public Law 96-480. This pilot test of the system, which could be scaled up if it proved successful, includes the requirement for research assessments. It includes the requirement for technical assistance and it includes the requirement for establishing a liaison function within the laboratories that would be involved.

So, we are very excited about the possibility of working with the rural communities and others as well on the idea of developing a new network relationship which the legislation in a sense calls for, that will involve the laboratories, the extension system, the land grant universities, and the local governments, States, counties, in a cooperative effort of technology transfer.

Mr. Watkins. Thank you. I know the other panels of energy and transportation, they are going to need that assistance somewhere along the way.

Mr. Chairman, I thank you again for allowing me to be involved. Sometimes my wife accuses this work here on technology transfer of being my love, but I think it's the answer to the future of a lot of our problems.

Mr. Linhares. Mr. Chairman, one of the major thrusts within our office is with regard to rural transportation. We have for a number of years now been developing and extensively disseminating to rural areas information on transportation systems and how they can go about implementing and operating them.

Mr. Watkins. If I can ever get this dissemination system to include money, that will be great. [Laughter.]

Mr. Walgren. Mr. Roberson?

Mr. Roberson. Thank you, Mr. Chairman. I do have a prepared statement prepared that I would like to enter into the record. I will make this as brief as possible.

I am the Director of the Technology Transfer Division of the Office of Space and Terrestrial Applications at NASA. Certainly, we cannot plead that we have been in the technology transfer business as long as the Department of Agriculture, but we have been in the business since the Space Act assigned mandate for NASA to disseminate the results of our technology.

The activities of NASA, alluded to by Senator Schmitt and others, include a great deal of directly embodied technology transfer activities. For example, the aeronautics proram and the communications program are designed so that their resultant technologies are transferred to the private sector along with the public benefit that that accrues.

We have in place, and have had for a number of years, technology utilization offices at each of the NASA field centers. These offices meet the requirements of section 11 of the Stevenson-Wydler Act. They are staffed depending upon the level of activity and the number of projects on going in any given year. There are normally from 1 to 10 people at each of the 10 laboratories that NASA manages. The people in these offices are full-time professionals involved in transferring technology; responding to requests from State and local governments and industry; promoting reports of any new technology and innovation; and feeding that information to our dissemination and publication network which provides information to industry.

The success of that program is indicated by the industry response to our published technical briefs. We received over 200,000 requests for follow-up information on technical data last year. Our studies indicate there is about an $11 return for every dollar put into that program.

Another part of the program is external to NASA, and consist of a network of 10 industrial application centers [IAC's]. These IACs make it possible for a company to solve a problem without duplicating research previously conducted in the Federal system or the private sector.

These lenders have access to over 250 computer-based technical data bases and to faculty talent. So, a company, State government, or any other individual that comes to one of these centers is almost certain to get some beneficial technical help.

Mr. WALGREN. These are NASA-operated centers?

Mr. ROBERSON. Most of them are jointly funded between ourselves and universities. One or two are not with universities, but also are jointly funded. They charge a fee for their services and revenue thus generated is allowed to remain with them as part of their operating budget. Since the beginning of these centers NASA's funding has decreased as a percentage of the operating cost, and the universities have maintained their share at 14 percent. The NASA contribution has gone from 50 percent to less than 33 percent, and revenues from sales and services support about 52 percent of the operating costs of the network.

This growth in revenue is an indication of success in that customers keep coming back and paying for the services that the IACs supply.

In addition to the technology utilization program that sponsored these offices and projects, examples of which are described in my prepared testimony, three of NASA's field centers have been highly visible to State and local governments over the last few years, although they do work with private concerns as well. They transfer the technology of remote sensing and related analysis techniques to the natural resource managers of State governments.

That program has been going on for 3 years. A study indicates that since 1978, the States have learned enough about satellite and other remote-sensing data and natural resource data to invest over $20 million of their own funds using this technology.

The programs that we have conducted with the States are not programs in which we provide money. Rather, we provide them an opportunity to test the technology in our laboratories, have their people trained to use the technology, and then to make their own decisions as to what to do with it. That program has proved to be quite successful. Approximately 22 States are committed to routinely using georeferenced information systems that use satellite data.

I believe that these NASA programs and the personnel and resources that the agency applies to this transfer process meet the intent and purposes of the Stevenson-Wydler Act.

[The prepared statement of Mr. Roberson follows:]

Testimony by
Floyd I. Roberson

Subcommittee on Science, Research and Technology
Committee on Science and Technology
House of Representatives

Mr. Chairman and members of the committee: My name is Floyd Roberson, and I am Director of the Technology Transfer Division in NASA's Office of Space and Terrestrial Applications. Thank you for the opportunity to appear here today and to discuss NASA's efforts which relate to Public Law 96-480, the Stevenson-Wydler Technology Innovation Act. I would like to describe for you how NASA stimulates utilization of its technology and briefly review some results which I believe show NASA's responsiveness to the purposes of the Act.

The Technology Transfer Division manages the Technology Utilization Program and its network of Technology Utilization Offices located at all NASA Field Centers, as well as the Technology Transfer Program for remote sensing applications.

As part of the Technology Transfer Program, three NASA Field Centers have Regional Remote Sensing Applications Centers. These Centers, along with University based applications, and user requirements and awareness activities through organizations such as the National Conference of State Legislatures and the National Governors' Association have been largely responsible for developing and transferring the technologies for remote sensing data interpretation to state and local governments and the private sector. An important end objective of this program has been to develop and adapt new remote sensing technology in a manner which makes it responsive to the specialized needs of state and local governments and the private sector, as well as other Federal agencies.

A recent survey by the National Conference of State Legislatures (NCSL) and the National Governors' Association (NGA) identified the status of state government applications and investments in Landsat technology and the role of NASA's Technology Transfer Program in stimulating this progress. In 1978, four states had developed operational capabilities to analyze and apply Landsat data. Following cooperative state/NASA Technology Transfer projects, 22 additional states have developed or are in the process of developing such capabilities. In addition, 135 local or regional entities use, or are developing capabilities to use, Landsat data. The survey also found that the states have made major investments since the launch of the first Landsat in 1972 including: 1) approximately $28 million in total expenditure of funds; 2) over $5 million in expenditures for computer hardware and software to analyze Landsat images; 3) over 760 person years of staff time; and 4) purchase of 20,000 Landsat images ("photos") and 2,700 computer tapes. A total of 594 Landsat applications have been documented in the states, and 131 potential future applications not yet attempted in particular states have been identified. The report concludes that Landsat is proving to be an increasingly useful and often unique tool for gathering information on natural resources by state and local agencies.

Our cooperative activities with the State of Iowa provide a good example of NASA's Technology Transfer projects with states. An applications development project with Iowa resulted from participation of Iowa representatives in a legislative workshop on Landsat and geobased information systems sponsored by the National Conference of State Legislatures. Upon the request of Iowa legislators and the Governor, NASA entered into a cooperative project for the state to assess agricultural needs and the applicability of Landsat technology to those needs. This project resulted in the development of techniques combining Landsat data with soil and terrain information from other sources in a geobased information system for the purpose of identifying and mapping areas of potentially high soil erosion and identifying the loss of prime agricultural land in the State.

The data produced using these techniques have higher resolution than surveys previously produced by conventional sampling techniques and have proved extremely useful in directing field inspection programs. The results of this project were judged to be positive and led to an appropriation by the Iowa State legislature of a supplementary $125,000 for purchase of necessary equipment for an internal State operational capability. As has been the case with all such state projects, no NASA funds were supplied to the state, yet effective cooperation has led to a transfer and beneficial application of our technology.

In addition to activities with state government users, Landsat applications assistance is available to local governments and the private sector.

The National Association of County Officials (NACO) and the National Innovation Group (NIG) are providing assistance to NASA in a cooperative nationwide requirements and awareness activity. The project with NACO is designed to assist in program planning by aggregating the information needs of counties in the U.S. and to make those counties aware of emerging NASA space applications technology. The National Innovation Group will perform a similar regional function through workshops with municipal, county and substate regional groups primarily in the Northeast and in the West.

Joint Landsat Applications projects are currently underway involving both local government and private industry. In the state of Alaska, for example, NASA's Ames Research Center is working jointly with the municipality of Anchorage and with several Alaskan boroughs to integrate Landsat data into a geobased information system. The system is used for multipurpose resource management, such as transportation corridor mapping, urban development planning, and environmental impact assessment. As is normal in such projects, expertise in geobased information systems is required and is provided by one of a large number of qualified private firms. In this case, Environmental Systems Research, Inc. (ESRI), a private firm from Redlands, California, was selected. The involvement of a private firm in the project provides a basis for commercialization of resulting project techniques and a multiplier of overall benefits from the cooperative work.

In work related to the private sector, NASA is also participating in a cooperative project with the Pacific Gas and Electric Company in California. In this project, Landsat data will be integrated into a geobased information system for use in powerline corridor mapping, energy demand modeling, and power plant siting. Results of the project will be disseminated nationally by the Electric Power Research Institute.

The NASA Technology Utilization Program provides for dissemination and utilization of NASA developed technology. This program is managed at NASA Headquarters and implemented by Technology Utilization Officers at each NASA Field Center. Activities include publications which detail new technology developed in

NASA programs; Industrial Applications Centers, through which industrial and other potential users may obtain scientific, technical, and management information and expertise; State Technology Applications Centers, which focus on applying aerospace technology to the specific needs of state and local governments; a Computer Software Management Information Center, which provides aerospace developed computer programs which can be adapted to meet the needs of industry and government; and applications engineering projects in which NASA undertakes to adapt existing aerospace technology to meet specified needs of other government agencies and public sector institutions.

The basis for the technology publication effort lies with new technology reporting. NASA R&D contractors and Civil Service employees are required to report new innovations and inventions resulting from aerospace R&D. After screening, all relevant innovations are published in abstracted form as one to two page briefs in NASA's quarterly Tech Brief Journal. The Tech Brief Journal is distributed primarily to industrial and technical recipients, and is also distributed to public libraries, and state and local engineers on request. The types of users who benefit from this publication and the NASA technology it provides are shown in Figure 1.

A subscriber, using a reader service card, can request a substantially more detailed backup report, called a Technical Support Package, for any Tech Brief which is felt to be useful or beneficial. In 1980, there were over 200,000 such requests for more detailed information.

To promote technology transfer within the nation's industrial complex, NASA operates a network of Industrial Applications Centers (IACs) for the purpose of providing information retrieval services and technical assistance to industrial clients. The network's principal resource is a vast storehouse of accumulated technical knowledge, computerized for ready retrieval.

The IACs seek to broaden and expedite technology transfer by helping industry in finding and applying information pertinent to a company's particular project or problem. The philosophy behind the IACs is that it is wasteful to "reinvent the wheel," i.e., there is no need to duplicate research already accomplished and thoroughly documented in the data bank. By taking advantage of IAC services, individual businesses can save time and money while the nation benefits through increased industrial efficiency. The types of businesses served are indicated in Figure 2.

A related service to industry which I mentioned earlier is provided by NASA's Computer Software Management and Information Center (COSMIC) at the University of Georgia. COSMIC collects, screens and stores computer programs developed by NASA and other government agencies. Adaptable to secondary use by industry, government or other organizations, these programs are used to perform such tasks as structural analysis, electronic circuit design, chemical analysis, design of fluid systems, determination of building energy requirements and a variety of other functions. COSMIC maintains a library of some 1,600 computer programs. This facet of NASA's industrial assistance effort represents one of the largest and most successful areas of technology transfer.

An example of the technical assistance provided small business firms by NASA's Industrial Applications Centers is a research task performed for the National Perforating Corporation (NPC) of Clinton, Massachusetts. NPC, a member of the Industrial Perforators Association (IPA), is a supplier of perforated metals, plastics and other materials for screens, walkways, and other products used in a wide variety of industrial applications. The company sought to determine the safe loading thresholds of such perforated products. Unable to find the needed information, the company was considering the conduct of a study which would have entailed considerable expense.

Before going ahead with the study, the company requested assistance from NASA's New England Research Applications Center (NERAC) at the University of Connecticut. NERAC conducted an extensive computer search and supplied NPC an information package, including identification of a firm which had already accomplished substantial study, test, and evaluation of the strengths of perforated materials. NPC was then able to obtain the information from the firm at a fraction of what a new study would have cost in terms of dollars spent and time required to obtain the data. The NERAC study also provided NPC and the IPA with additional information about perforated materials in such areas as flow of gases and liquids over and through perforated plates, acoustical applications, and filtration. Assistance provided by NERAC will be shared among IPA's other member companies.

The Ferrofluidics Corporation, a small business firm in Nashua, N.H., spawned what will probably become a whole new industry based on ferrofluids--magnetic liquids whose unusual properties offer unique advantages in a wide range of industrial applications.

Ferrofluids had their genesis in the early days of the U.S. space program. At that time NASA faced the problem of how to feed fuel to the engine of an orbiting spacecraft when the fuel is weightless. A scientist at Lewis Research Center hit upon the idea of imparting magnetic properties to the fuel by dispersing within it finely ground iron oxide particles. The fuel could then be drawn into the engine by a magnetic source. Ultimately, NASA solved the problem by a different approach and ferrofluid research was shelved for the moment--but the Lewis investigations had planted the seed of a new technology.

The delay for introducing ferrofluid technology was shortlived. Two scientists from the AVCO Space Systems Division who had become knowledgeable of ferrofluids, left AVCO in 1969 to form the Ferrofluidics Corporation. Armed with a license for the NASA technology, they set about to find problems to which this unique technology might apply. Over the past decade, the company has found numerous applications of ferrofluids; the first being related to the manufacture of semiconductor "chips" for use in electronic systems. The resultant product, a ferrofluidic magnetic seal, was then applied to computer disc drives and inertia dampers for stepper motors. In recent years, ferrofluidics have grown in acceptance throughout industry in a variety of industrial processes, analytical instrumentation, medical equipment, silicon crystal growing furnaces, plasma processes, fusion research, visual displays and automated machine tools.

From a sales volume of $65,000 in 1969, the Ferrofluidics Corporation has expanded to sales in the multimillions and expects to top the $100 million level by 1990.

Applications engineering projects are the result of a public sector problem statement developed by a NASA sponsored Applications Team, or in many cases, a problem identified by another Federal agency. In the latter case, the Federal mission agency problem is often directly related to a similar state or local government problem. An example of such a transfer is the U.S. Coast Guard Firefighting Module.

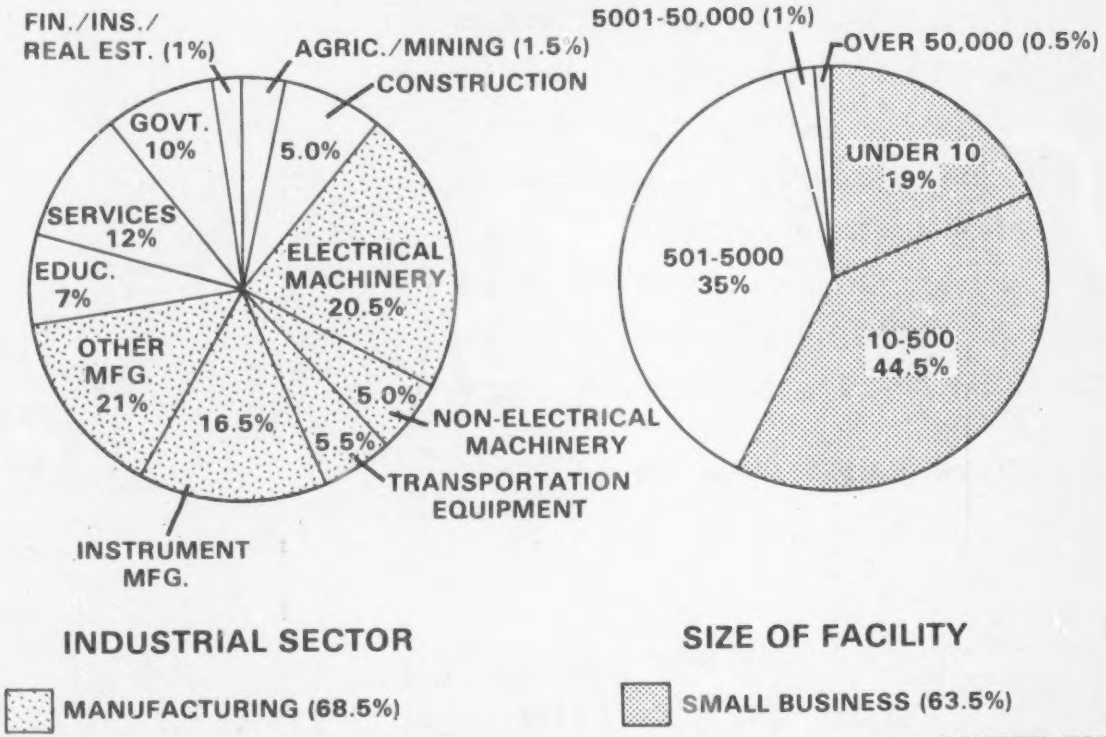
In January, 1979, the NASA Marshall Space Flight Center delivered a lightweight firefighting module to the Coast Guard. NASA aerospace technology made possible the development of a powerful, portable, lightweight, high capacity firefighting unit for use by the U.S. Coast Guard and other shipboard or harbor firefighters. The Coast Guard required that it be self-contained so that it could be transported quickly to remote areas or to the deck of a ship at, or en route to the scene of a fire. This unit pumps over three times its own weight in water every minute and throws a stream 250 feet.

Other applications for the portable, lightweight system include its use on light trucks by local fire departments; on docks and ships for harbor fires; for lake and pond drainage; fighting forest or grass fires or fires on offshore oil rigs and in high-rise buildings. It can also be used as an emergency booster pump for municipal water suppliers, oil spills, and in flood control and military operations. This pump is now commercially available from Aviation Power Systems Corporation.

In addition to these public sector projects and in compliance with the Space Act as amended, NASA has a major technology Applications effort in the areas of bioengineering and rehabilitation in cooperation with other Federal agencies and medical and research institutions.

All these activities represent current efforts which, in our view, satisfy the intent of the Stevenson-Wydler Act. NASA will continue to support efforts to transfer information where it is incidental to NASA R&D work and can be done largely without added burden to the taxpayer. For technology transfer work that seeks to tailor the results of NASA R&D to the needs of other non-Federal and private sector uses, we expect that the recipients of future direct NASA technology transfer support should increasingly bear the transfer costs through user fees, as an alternative approach, consistent with the provisions of Section 11(b).

INDUSTRIAL MAILING LIST PROFILE

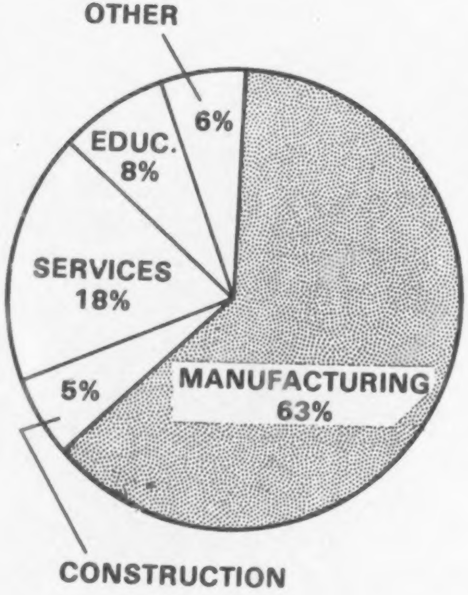


NASA HQ ET80 4307 (1)
7-15-80

Figure 1

DISSEMINATION CENTERS

IAC CLIENT DISTRIBUTION BY USER CATEGORY



▨ **MAJOR MANUFACTURING SECTORS**

- ELECTRICAL EQUIPMENT & SUPPLIES (10.8%)
- MACHINERY (EXCL. ELECTRICAL) (8.6%)
- CHEMICALS & ALLIED PRODUCTS (8.4%)
- FABRICATED METAL PRODUCTS (6.3%)
- INSTRUMENTS & RELATED PRODUCTS (5.2%)
- PRIMARY METALS (2.4%)
- RUBBER & PLASTIC PRODUCTS (2.4%)
- TRANSPORTATION EQUIPMENT (2.4%)

Figure 2

NASA HQ ET80-4333 (1)
7-31-80

Mr. **Walgren**. OK. Thank you very much.

Mr. Shamansky?

Mr. **Shamansky**. Thank you, Mr. Chairman.

The record of technology which NASA has transferred to the private sector as you described it is impressive. Could you describe how NASA is complying with the mandate of the Stevenson-Wydler Act in setting aside personnel and funds specifically for this transfer function?

Mr. **Roberson**. As I said, each of our laboratories has an office which is manned by at least 1 person, and up to as many as 10 persons. We have not changed the name of those offices to technology research and applications offices as suggested in Public Law 96-480. We call them technology utilization offices and they are known around the country as such.

Mr. **Shamansky**. Do you have any suggestions for making the transfer better other than an increase in the budget? In other words, are there any technical barriers, legal barriers to your doing a better job?

Mr. **Roberson**. I wouldn't say there are legal barriers, no, sir.

Mr. **Shamansky**. How about administrative?

Mr. **Roberson**. No. The barriers are different with each individual transfer problem. Our program has been operating for 17 years. As an integral part of that program, we have maintained an independent evaluation contract with the Denver Research Institute so that we are continuously evaluating what we do. You will find that very few of the techniques we have today are the ones we had 12 years ago.

Mr. **Shamansky**. You do respond to the results of these evaluations?

Mr. **Roberson**. Yes, sir.

Mr. **Shamansky**. What do you do about sharing the results of your evaluation with your counterparts in area agencies? Is there any cross-fertilization among you?

Mr. **Roberson**. There is a great deal at hearings like this one. [Laughter.]

Mr. **Shamansky**. No. You cannot wait for us to do it.

Mr. **Roberson**. We share our work. We cooperate. As a matter of fact, Al Linhares of DOT was talking about his firefighting research station in Mobile, Ala., just moments ago. That was the center that did the evaluation for the Coast Guard firefighting module described in my written statement. So, we cooperate in many respects with the other agencies.

With the Department of Energy, we have many ongoing joint projects and we also have had some joint projects with the Department of Agriculture. For example, we had a joint program for the adaptation of image analysis techniques to be used in grading meats, and one for detecting the estrous status of cows so the proper time for insemination of cattle can be determined.

Mr. **Shamansky**. You mentioned that they cooperate with the universities, with these centers. You just now mentioned cooperation with the other Federal agencies. What kind of a record of cooperation do you have with the private sector?

Other than that there has been access to these places where they can get information.

Mr. **Roberson**. We take great care not to put ourselves in a position of being the sole source of service after we do an adaptive engineering project that takes our technology and matches some need that is brought to us by another Federal agency. For example, we developed a lightweight turbine pump in response to a request from the Coast Guard. We did not want to get in a position of being a pump supplier, so we sought out a private supplier. All of our projects are managed this way. We initially do a market assessment and a preliminary engineering analysis and determine if we have the technology to solve that problem. If it looks like a viable match between technology and the problem, we advertise for and select a joint venture partner from the private sector. We use our funds and the private company has to put in its own funds. We help in the prototype development. We manage the project just as we would a space project and try to complete it on schedule. We get whatever agency approval is required for each project. If it is the National Institutes of Health or a similar agency to act as a broker to that agency then we allow the involved private company to go to the marketplace with the product. All that information is also publicly available to other companies. We work closely with people on these projects. In the remote-sensing area, we have worked with the forestry industry to help them develop information systems. The States which have bought the $20 million worth of equipment I mentioned earlier have bought it from the private companies who have been involved in our projects.

In fact, most of the training that the State people get is from contractors. So, we cooperate with them as extensively as possible.

Mr. **Shamansky**. I find that a very reassuring description of what your agency is doing. Thank you, Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Shamansky.

Do you ever sense that the private agents that you use do not sit on the technology, or do not expand it or broaden it to the extent that might be possible?

Mr. **Roberson**. Let me separate that into two questions. When it is a project that we are managing from my division, which was established specifically to disseminate NASA technology, we don't have that problem. For other research and development projects where technology is being developed for strictly aerospace needs, there are times when an aerospace company may not actually sit on a technology because they want to hold it back, but rather because it is not in their interest to transfer it at that time. In other words, it is not part of their marketing strategy to look for additional applications. It is rare to find an aircraft company that wants to build neurosurgery equipment.

Mr. **Walgren**. Does that involve patent laws?

Mr. **Roberson**. We are in a period of transition concerning patent laws, but all material is to be reported to NASA and then NASA applies for patents. The contractor who is doing the research can specifically request a waiver. If it is an area of technology in which they have the expertise, they are often allowed to maintain the information. If it is not waived to the contractor during the development phase, the technology is normally patented and becomes the property of the Government. It is available for that contractor or anyone else to request a patent license.

Normally, the inventions board of NASA will respond by giving a nonexclusive license if that is possible. The next desirable thing would be to give an exclusive license in the field of use so that an aircraft company might use its new technology in the aircraft industry, but NASA would maintain the rights for applications in other fields.

Mr. **Walgren**. Let me ask the other members of the panel the same question that was addressed to Mr. Roberson, the question about what are your frustrations, what barriers do you run into that are not financial or bureaucracy? What potential do you see that is not being realized? Mr. Linhares?

Mr. **Linhares**. I think one of the factors as I stated in my testimony, deals quite a bit with State and local governments. Although there are now many exceptions, one of the factors that has been somewhat inhibiting with regard to innovating has been risk aversion. In other words, because you are dealing with a political environment at State and local levels, there can often be a tendency not to want to do anything "creative" or "dramatic" because you are not certain of the results. It is better to stick with the tried and true rather than try something new and fail, especially when your election is coming up in 1 year or 6 months. This is a fact of life.

One of the things we have been doing with regard to getting around this barrier—and I stated this in my testimony—our office very much concentrates on the elected official. We feel they have been ignored in the past with regard to technology sharing. That is, we dealt with the transportation operators, and the State highway departments and those kinds of people, and generally avoided the elected officials. That has changed over the last few years. Much of the material in conferences and workshops that we have now are actually aimed at the elected and appointed officials and their immediate staffs. I have noticed an increasing understanding and an increasing interest in wanting to innovate as time goes on, as more understanding is obtained. I think that is one of the keys. And in fact many elected and appointed officials are now at the forefront of trying to use innovative knowledge and technologies.

Mr. **Walgren**. Ms. Joseph?

Ms. **Joseph**. I don't think there is any single barrier in the Department of Energy. But one area that dearly requires more effort on our part is to make the opportunities and capabilities known to the potential customers, both industry, and I think even more so, State and local governments. We are doing that on a laboratory-by-laboratory basis, but, we need to improve this process in a coordinative fashion, perhaps one that is more centralized.

Presently, we are very decentralized in our efforts. A lot of what we are doing is regionally oriented. We plan to improve that, and as a matter of fact, we are using the impetus of the act to ensure that we do. We plan to issue a strong policy statement and request yearly reports that will be disseminated broadly and reach more potential customers, particularly State and local governments.

Mr. **Maher**. The four or five barriers that I would mention are basically institutional or administrative. I think in a few of them, you can't get away from the question of the budget implications. But let me suggest one barrier in trying to implement the kind of thing you are after in Public Law 96-480. It is the notion of conflicting priorities. That is, the research centers have a mission to perform and that mission is directed at the mandate of the agency with which they are affiliated. There is a great reluctance on the part of many laboratories and research centers to divert their resources, not only money but oftentimes more importantly, their personnel resources, into secondary applications of research in which they see no direct relevance to the mission responsibility. One barrier, therefore, would be conflicting priorities as perceived by the researchers in the laboratories.

Related to that is a barrier I would call information gaps. There is not a lot of understanding in the user community, not only the business community, but also State and local governments particularly, as to what the laboratories have to offer.

If local and State governments turn for help on different kinds of problems, they don't naturally turn to laboratories as a source of support. Part of this is a problem of the laboratories' inability or lack of communication on what they have to offer the user community.

There are compilations, directories, that list the capabilities of different laboratories. But often the mission statements are very pretentious and they don't convey adequately the kinds of resources that the user needs day-to-day to solve problems.

There needs to be some translation of these statements into an operational meaningfulness that can be used by the communities that we are targeting on.

Part of the information gap problem I suppose also is that public officials don't normally think of their problems in terms of science and technology even though those problems relate back to technology issues. They have problems in translating their day-to-day needs for street maintenance, for traffic signals, or solid waste management problems into issues that are researchable by the laboratory community.

So there needs to be some kind of a connective between the user that thinks in terms of dollars and policy issues and the researcher that thinks in terms of a scientific problem.

The other barrier that is related is the need for adaptation. And here, we are getting back into the money question. It is true as Congressman Brown has said that the laboratories are a warehouse of research that can be applied to domestic problems.

However, it is not possible simply to say all we have to do is to move the research out of the warehouse and to the user. There is often required adaptation that takes the research that is stated in a scientific sense and solves that kind of a problem and adapts it to the realities of the political environment, perhaps, in local and state government, or in the business community.

So part of that is the problem of money. Part of it is the problem of having people who understand not only the research side, but also understand the realities of the user environment.

Maybe that calls into need a new kind of person with a different disciplinary background, not just the physical and natural sciences, but somebody who understands the social sciences, economics and politics.

A last one I will mention would be the problem of business competition. Nobody has sorted out effectively how we draw the chalk lines between what is properly a responsibility of a business community in the R. & D. sense, and what the laboratories legitimately can get involved with, in moving research from the basic and early applied stage into usable products and development efforts.

Partly those are money problems, but I think mainly they are management and institutional kinds of problems that have to be faced.

Mr. **Ertel**. I was here when Senator Mathias testified. He had basically a technology transfer seminar in Baltimore which was an attempt to take laboratory systems and move the information from laboratories and the science community into the business community, and I guess the governmental community as well, State and local.

Obviously the Stevenson-Wydler act is a much broader concept than that. It would be a permanent thing. That would certainly be a good idea, whether or not the act would really work. I wondered if any of you participated in that.

Mr. **Linhares**. Yes.

Mr. **Ertel**. What were your impressions, speaking candidly, as to whether it was successful, whether it worked out in any way, shape, or form, or whether it was just an exercise in showmanship?

Anyone want to respond to that?

Mr. **Linhares**. Well, I will take a first cut. We have participated in a number of these kinds of conferences. In fact the Congress has become very interested in them. Congressman Dodd held one up in Connecticut which was of the same nature.

I think at all of these, there are a number of people who come and become interested in the information that is presented. Some of them get turned on, so to speak. My feeling is that if you can get perhaps five percent of the people who are participating for the first time interested in technology transfer and interested in the possibility of applying new techniques to their problems, then I feel it is worthwhile.

I have the feeling that that occurred at the Baltimore conference.

Mr. **Ertel**. Anybody else have any impressions? I am kind of curious.

Mr. **Maher**. Well, I think it is a useful exercise in trying to match up what some of the agencies have to offer in their R. & D. stockpile with interested businesses. There is a reluctance in some agencies these days to go beyond the basic and applied stage in terms of relationships with the private sector.

Mr. **Ertel**. Why is that?

Mr. **Maher**. I think there is a reluctance to get into the development end of the R. & D. spectrum, and that that is more properly a function of the private sector, commercialization of products. We had an example in agriculture of a product known as Bagasse which is a byproduct of sugarcane production. Basically it has potential for use in building materials—walls, floors, roofs. The problem is how do you move that investment in R. & D. from the research stage into a commercializable product?

Industry is reluctant to move because they want to be sure there is a market involved. They don't want to invest stockholders' money in any kind of adaptive engineering. So where is the proper role?

Is that a role for the Federal Government to play? To prove a concept so that industry would pick it up and market it—I think those issues are the ones that were explored in Baltimore with no real resolution as to what the proper relationship should be.

Mr. ERTEL. Mr. Roberson?

Mr. ROBERSON. I also participated in several of these conferences, including the one Congressman Dodd held, and two that Senator Mathias sponsored, one for local government and another for small businesses.

I think these conferences do have a role to play. They are probably of most benefit to the small businessman who is in the research mode and wants to explore what is available. If you compare them with other types of conferences, I think that those designed more on an individual user basis, may be the more effective.

NASA and the Small Business Administration recently sponsored a conference at the Langley Research Center. We invited several thousand businesses and several hundred attended. They were mainly small manufacturing businesses with requirements for manufacturing, testing, and processing technologies that are available at the NASA laboratory.

Expending the same amount of effort, we had another conference which specifically targeted technologies to users and I think we probably had a higher percentage of success with that type of conference. We also participate in conferences that are sponsored by industry associations, where specific technology matching occurs. The people who attend these conferences are technically targeted for the kind of technology information they are likely to get. At our conferences, we are not likely to get people who would go to a conference if it involved, for example, Al Linhares' highway concerns.

That is where you can make some major breakthroughs with conferences such as those sponsored by Senator Mathias.

Someone may have made a decision not to go to a specific NASA conference because they think that NASA may not have any applications for their concerns. This same person may want to go to such a general conference. They may then find that there are NASA technologies that don't relate specifically and exclusively to spacecraft, and so may discover a whole new resource they may otherwise have ignored.

So, I think these general conferences also have a role to play.

Ms. JOSEPH. I didn't attend the Baltimore conference, but a number of people from the Department of Energy laboratories and some of my staff went. Without going into detail on the pluses and minuses, they learned a lot about what to do and what not to do in the forthcoming conference that they are setting up in Albuquerque.

I would like to invite you to that one. It is the Showcase for Technology Conference, sponsored by Senator Schmitt. It will be held October 28-30.

Mr. **Ertel**. I will certainly try and be there because it struck me as an interesting aspect.

Pennsylvania is a heavily industrialized manufacturing State. I was thinking it was a possible thing to do in that area because—we do have some technology transfer to the State governments—because it has not been overly enthusiastic. I wondered what your impressions were before I got to that idea. I might come out to Albuquerque to see that one. I think technology transfer is a problem.

Mr. **Walgren**. Thank you very much for testifying and being with us today. We hope that we will see you soon.

[The panel's answers to questions from the subcommittee and Mr. Watkins follow:]

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

AUG 28 1981

Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

This is in response to your letter of July 23, 1981, requesting information to complete your record of the hearings on implementation of the Stevenson-Wydler Technology Innovation Act. The enclosed materials contain the questions you submitted and our answers.

Thank you, Mr. Chairman, for providing me the opportunity to appear before the Subcommittee and reaffirm USDA's long-standing commitment to emphasizing technology development and transfer through research and extension.

Sincerely,

Anson R. Bertrand

ANSON R. BERTRAND
Director
Science and Education

Enclosures

Question: The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established at each Federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office may elect to combine the Office within the existing organization. Please provide the Subcommittee with a list of Federal laboratories owned and funded by your agency (whether or not operated by your agency).

For each laboratory on the list, please give the total annual budget for FY 1981, and the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applications. If the ORTA is combined with an existing organizational structure, name the structure.

Answer: Provided below are seven major Agricultural Research Service laboratories owned and funded by USDA, S & E, Agricultural Research Service, together with the information requested, providing the total annual budget for FY 1981, and naming the chief staff person for ORTA, their title, address and telephone number, in that order.

1. Western Regional Research Center: $11,329,300

   Dr. Arthur T. Morgan, Sr., Center Director, WRRC
   800 Buchanan St., Berkeley, CA 94710
   Tel. 415-486-3506, FTS-360-4251

2. Northern Regional Research Center: $12,894,900

   Mr. William H. Tallent, Center Director, NRRC
   1815 N. University, Peoria, IL 61604
   Tel. 309-685-4011, FTS-360-4251

3. National Animal Disease Center: $11,424,400

   Mr. Phillip A. O'Berry, Center Director, NADC
   National Animal Disease Center
   P.O. Box 70, Ames, IA 50010
   Tel. 515-232-0250, FTS-862-8201

4. Southern Regional Research Center: $10,962,900

   Dr. Iwan W. Kirk, Acting Center Director, SRRC
   1100 Robert E. Lee Blvd.
   P.O. Box 19687, Room 2004, New Orleans, LA 70179
   Tel. 504-589-7511, Exts. 7511-7512, FTS 682-7511

5. Beltsville Agricultural Research Center: $51,102,800

   Mr. Paul A. Putnam, Center Director, BARC
   Bldg. 003, Room 227, BARC-West
   Beltsville, Md. 20705
   Tel. 301-344-3078, FTS-344-3078

6. Plum Island Animal Disease Center: $10,316,000

Mr. Jerry J. Callis, Center Director, PIADC
P.O. Box 848 - Greenport, Long Island, NY 11944
Tel. 516-323-2500, Exts 208, 209, FTS-649-9500

7. Eastern Regional Research Center: $11,136,500

Mr. Herbert L. Rothbart, Center Director, ERRC
600 East Mermaid Lane
Philadelphia, PA 19119
Tel. 215-233-6593, FTS-489-6593

Question: What is your agency's total research and development budget for FY 1982 expected to be?

Answer: The total amount of the Science and Education budget for FY 1982 that is related to research and development is $702,657,000. This includes $10,000,000 proposed legislation for facilities construction at 1890 colleges and Tuskegee Institute.

Question: What is your agency's total budget for the technology transfer function, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982? Please provide a breakdown of the technology budget into whatever detail is used to calculate it.

Answer: The total Science and Education budget, including research and development for FY 1982 is $1,029,306,000. Of this amount, approximately 30.8% or 317.4 million dollars will be expended by the Extension Service for transferring technology to users such as state and local governments, and farm and non-farm communities as a part of the mission of the Science and Education.

Question: What technology transfer activities are being undertaken by USDA to satisfy the requirements of Section 11 (c) of P.L. 96-480 that mandates a) application assessments of R&D projects, b) information dissemination, c) cooperation with other agencies and labs, and d) technical assistance on behalf of local governments, State governments, and businesses?

Answer: The Department of Agriculture has long maintained a system to bring together the Department and its constituency. The Extension Service has maintained a network of field stations that provide a constant interactive process between the developers and users of scientific and technological advances.

Traditionally, USDA has maintained several levels for communications between the Department and its constituency. In addition to the Extension Service, it has the Cooperative State Research Service, Agricultural Research Service, the land grant university system, and an active policy and user advisory system.

Scientific and technological advances developed within this system are relayed through Extension or directly to the users, primarily in the Agriculture Community. In the course of this continuous interactive relationship the functions called for in section 11 (c) are being provided.

In relation to the "non-traditional clients" of USDA -- local governments, States and non-agricultural related businesses -- new ground is being plowed. In cooperation with the U.S Conference of Mayors, the Extension Service, the State Agricultural Experiment Stations, and Agricultural Research Service, pilot demonstration programs are being planned that will link these research resources with selected local governments.

These pilot programs will include concerted efforts to design a system for assessing research projects relevant to local communities, linkages with other agencies and their research base, and technical assistance through the Extension system working with local officials to transfer research results.

Question: What portion of the Agency's technology transfer effort constitutes a corporate mission responsibility with a high agency priority?

Answer: From its inception USDA has had an affirmative policy to encourage R&D centers to transfer science and technology results to users. The past mandate has been directed largely at agricultural users rather than the local government clients and others identified in P.L. 96-480.

However, some of Extension outreach and community service touches on the local government problems. In fact hundreds of person years are being devoted to what is called "community and rural development" effort.

Through the local government demonstration projects of the Conference of Mayors, USDA will seek to couple this Extension effort with the R&D research base, thereby further institutionalizing technology transfer as a mission responsibility.

Question: What is your Department doing now to promote technology transfer that it was not doing prior to enactment of Stevenson-Wydler?

Answer: We have embarked on a cooperative arrangement with the U.S. Conference of Mayors to develop a local government Extension laboratory relationship for problem solving. The test sites will be in Maryland and Oklahoma. It will embrace all of the component elements of section 11 (c) -- research assessment, information exchange, interagency cooperation and technical assistance.

Department of Energy
Washington, D.C. 20585

August 18, 1981

Honorable Doug Walgren
Chairman
Subcommittee on Science,
Research and Technology
House of Representatives
Room 2319, Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Mr. Walgren:

Enclosed are the responses to the questions in your July 23, 1981 letter regarding the July 16, 1981 hearing, concerning the implementation of the Stevenson-Wydler Technology Innovation Act.

If you have any questions, please call Ingrid Nelson or Tom Pretorius of my staff on 252-4277. They will be happy to assist you.

Sincerely,

for Thomas H. Pretorius

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosures

Questions from the Subcommittee on Science, Research and Technology

1. The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established ct each Federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office may elect to combine the Office within the existing organization.

(a) Please provide the Subcommittee with a list of Federal laboratories owned and funded by your agency (whether or not operated by your agency.)

(b) For each laboratory one the list described in (a) please give
(i) the total annual budget for FY 1981
(ii) the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applicatios. If the ORTA is combined with an existing organizational structure, name the structure.

Answer

Laboratory and Address	($ Millions) FY 1981 Budget	Staff Person
Sandia National Laboratories P.O. Box 5800 Albuquerque, New Mexico 87185	663.6	E.P. Quigley Supervisor, Design Information and Specifications Div. (505) 844-8762
Lawrence Livermore National Laboratory University of California P.O. Box 808 Livermore, California 94550	586.1	Gerald T. Richards Technology Transfer Officer (415) 422-6416
Los Alamos National Laboratory University of California P.O. Box 1663 Los Alamos, New Mexico 87545	489.9	Eugene Stark, Jr. Industry Liaison Officer (505) 667-1230
Oak Ridge National Laboratory P.O. Box X Oak Ridge, Tennessee 37830	435.5	Donald W. Jared Research Applications Officer (615) 574-4193
Argonne National Laboratory 9700 South Cass Avenue Argonne, Illinois 60439	320.2	Richard Ivins Director, Office of Industry Marketing Sciences (312) 972-7694

Laboratory and Address	($ Millions) FY 1981 Budget	Staff Person
Idaho National Engineering Laboratory Idaho Falls, Idaho 83401	316.0	J. Ernest Wilkins Deputy General Manager for Science & Engineering (208) 526-1095
Brookhaven National Laboratory Upton Long Island, New York 11973	216.4	T.E. O'Hare Chairman, Energy Technology (516) 282-3428
Bettis Atomic Power Laboratory P.O. Box 79 West Mifflin, Pennsylvania 15122	203.4	See Note*
Knolls Atomic Power Laboratory P.O. Box 1072 Schenectady, New York 12301	190.1	See Note*
Pacific Northwest Laboratory P.O. Box 999 Richland, Washington 99352	146.1	Loren Schmidt Manager of Planning (509) 375-2559
Hanford Engineering Development Laboratory P.O. Box 1970 Richland, Washington 99352	145.5	Ron Bliss Manager of Strategic Planning & Organizational Development (509) 376-3998
Lawrence Berkeley Laboratory University of California Berkeley, California 94720	139.1	Robert J. Morris Office of Technology Applications (415) 486-6502
Solar Energy Research Institute 1617 Cole Boulevard Golden, Colorado 80401	138.5	Dana Moran Assistant to the Director (303) 231-7115
Pittsburgh Energy Technology Center** P.O. Box 10940 Pittsburgh, Pennsylvania 15236	137.4	William Peters Manager, Technical Information Services (412) 675-6251

*These laboratories perform R&D on naval reactors to meet military requirements of the Navy. Technology transfer activities are coordinated by Carl H. Schmitt, Exec. Asst. for Security, Public & Foreign Matters, at DOE headquarters, 252-5564.

**Includes Carbondale Mining Technology Center and Pittsburgh Mining Technology Center

Laboratory and Address	($ Millions) FY 1981 Budget	Staff Person
Princeton Plasma Physics Laboratory Princeton University P.O. Box 451 Princeton, New Jersey 08540	135.9	Robert G. Mills Head, Engineering Program (609) 683-2469
Fermi National Accelerator Laboratory P.O. Box 500 Batavia, Illinois 60510	121.6	John McCook Assistant Director (312) 840-3211
Morgantown Energy Technology Center P.O. Box 880 Morgantown, West Virginia 26505	89.6	Augustine A. Pitrolo Director (304) 599-7511
Savannah River Laboratory Aiken, South Carolina 29801	78.7	A.H. Peters Manager (803) 725-2277
Stanford Linear Accelerator Facility Stanford University P.O. Box 4349 Stanford, California 94305	64.0	Eugene B. Rickansrud Associate Director, Business Services Division (415) 854-3300 Ext. 2217
Laramie Energy Technology Center P.O. Box 3395 University Station Laramie, Wyoming 82071	46.7	J.P. Watson Acting Director (307) 721-2212
Energy Technology Engineering Center P.O. Box 1449 Canoga Park, California 91304	32.3	Guy Ervin, III Member of the Staff (213) 341-1000 Ext. 6474
Bartlesville Energy Technology Center P.O. Box 1398 Bartlesville, Oklahoma 74003	29.1	C.C. Linville Information Officer and Chief, Technology Transfer Section (918) 336-2400
Ames Laboratory Iowa State University Ames, Iowa 50011	20.0	Dan Williams Assistant Director for Science & Technology (515) 294-2635

Laboratory and Address	($ Millions) FY 1981 Budget	Staff Person
Oak Ridge Associated Universities P.O. Box 117 Oak Ridge, Tennessee 37630	12.3	Philip Johnson Executive Director (615) 576-3300
Grand Forks Energy Technology Center P.O. Box 8213 University Station Grand Forks, North Dakota 58202	9.1	Phillip G. Freeman Safety Officer (701) 759-8109
Bates Linear Accelerator Facility Massachusetts Institute of Technology P.O. Box 95 Middleton, Massachusetts 01949	8.3	P. Demos Director (617) 245-6600
Inhalation Toxicology Research Institute Lovelace Biomedical and Environmental Research Institute P.O. Box 5890 Albuquerque, New Mexico 87115	8.0	Robert Jones Associate Director (505) 844-2502
Environmental Measurements Laboratory 376 Hudson Street New York, New York 10014	5.9	Herbert L. Volchok Director (212) 620-3616
Laboratory for Nuclear Medicine and Radiation Biology University of California 900 Veteran Avenue Los Angeles, California 90024	4.0	Owen R. Lunt Director (213) 825-9431
Laboratory for Energy and Health Research University of California Davis, California 95616	3.9	Moshe Shifrine Acting Director (916) 752-1341
Center for Energy and Environment Research University of Puerto Rico Caparra Heights Station San Juan, Puerto Rico 00935	2.6	William Ocasio Asst. Director for Planning and Development (809) 767-0321

Laboratory and Address	($ Millions) FY 1981 Budget	Staff Person
Notre Dame Radiation Laboratory University of Notre Dame Notre Dame, Indiana 45556	2.5	Robert H. Shuler Director (219) 283-7502
University of Rochester Biomedical Laboratory School of Medicine and Dentistry Rochester, New York 14642	2.4	Paul L. LaCelle Director (716) 275-3723
New Brunswick Laboratory 9800 South Cass Avenue Argonne, Illinois 60439	2.3	Carleton D. Bingham Director (312) 972-2446
Laboratory of Radiobiology- University of California School of Medicine University of California San Francisco, California 94143	2.1	Harvey M. Patt Director (415) 666-1636
Radiobiology Laboratory University of Utah Building 351 Salt Lake City, Utah 84112	1.9	McDonald E. Wrenn Director, Radiobiology Division (901) 581-6600
Savannah River Ecology Laboratory Drawer E Aiken, South Carolina 29801	1.9	Michael H. Smith Director (803) 725-2472
Comparative Animal Research Laboratory 1299 Bethel Valley Road Oak Ridge, Tennessee 37830	1.5	H.E. Walburg Director (615) 576-4008
MSU-DOE Plant Research Laboratory East Lansing, Michigan 48824	1.5	Gary W. Watson Administrative Specialist (517) 353-2270

2. (a) What is your agency's total research and development budget for FY 1982 expected to be?

   (b) What is your agency's total budget for the technology transfer function, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982?

   (c) Please provide a breakdown of the technology transfer budget (as described in (b) above) into whatever detail is used to calculate it.

Answer

(a) The budget transmitted by the President to the Congress on March 10, 1981 included the following estimates for the Department of Energy's research and development effort:

	Millions of Dollars	
	Obligations	Outlays
Conduct of R&D	4,690	4,858

(b) Our best estimate at this time is that technology transfer expenditures in FY 1982 by the Department laboratories will be approximately $40 million. This does not include expenditures of about $15 million for information dissemination by the Technical Information Center.

(c) Of the $40 million identified above, technology transfer to industry is estimated at $28 million and to State and local governments at $5 million. Similarly, of the $40 million, transfer of mission-related technology is estimated at $32 million and of "spin-off" technology at $7 million. These sets of figures do not sum to $40 million because some laboratories were not able to breakdown their technology transfer totals in this manner.

Questions by Mr. Watkins

1. There seems to be quite a misconception among the agencies as to what Congress intended when it mandated technology transfer in Section 11. Technology transfer was defined, for purposes of the Act, as the four functions listed in Section 11(c). These functions are:

   1) Preparation of application assessments for R&D projects.
   2) Provide and disseminate information.
   3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community.
   4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

   It is important to stress that "information dissemination" comprises only one-fourth of our definition of tech transfer. In fact, during the hearings from which the legislation was developed, we discovered that a number of labs and agencies were disseminating information, but very few were taking the other three steps.

   Please provide for the record a breakdown of all the tech transfer activities you have cited as satisfying the requirements of the Act, and indicate into which of the four classifications each falls.

Answer

Only a very few of the large number of examples of technology transfer by the Department laboratories were cited in the testimony. To put the answer to the question in better perspective, the following table identifies the estimated FY 1982 expenditures.

($ millions) by the Laboratories in each of the four classifications.

Applications assessments:	$4.1
Information dissemination:*	20.2
Cooperation with technology transfer brokers:	1.7
Assistant to public sector:	4.6

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* This does not include the FY 1982 budgeted expenditure for information dissemination by the Technical Information Center of about $15 million.

2. Many agencies have tended to cite as tech transfer "success stories" examples where technology found its way into the public and private sectors, but did not start out as direct tech transfer activities.

   This Committee's report which accompanied the Act makes it very clear that this does not satisfy the tech transfer requirements of the Act. Let me quote from Page 32 of the Report:

   "... (T)he overriding consideration in making a determination as to what should be categorized as technology transfer is that the activity so classified should be dedicated to technology transfer from the outset (emphasis added)."

   Based on that definition, how much of the tech transfer activities you've taken credit for this morning would still be considered tech transfer for the purpose of the Act?

Answer

The testimony cited only a very few technology transfer examples. We believe our response will be more informative if we indicate our planning for FY 1982, when the Act will be fully operative. Approximately $40 million is expected to be spent on technology transfer activities by the Department laboratories in FY 1982. Of this amount, an estimated $25 million is considered to be "preplanned" technology transfer in the sense of the Act.

3. What is your Department doing now to promote technology transfer that it wasn't doing prior to enactment of the Stevenson-Wydler Innovation Act?

Answer

The Department of Energy's R&D effort, unlike NASA's or DOD's is entirely devoted to the discovery and development of technologies which produce, modify, or conserve energy and which are accomplished only when transferred to the private sector. DOE's early review of the Stevenson-Wydler Act revealed that this activity, which had been going on since the creation of the agencies that were combined to form the DOE, was already integrated into the management of our R&D activities. It was also evident that there were other important applications of research and development performed by DOE, which could be exploited by the private sector in energy and nonenergy fields, and which were clearly within the intent of the Act. Therefore, DOE engaged in a series of activities to thoroughly review historical acts of technology transfer, the current status of that activity, and to formulate plans for more effective response to the Act. These activities are still underway, although several accomplishments deserve note.

DOE established a temporary interim task force, chaired by the Office of Energy Research (ER) to review and identify the technology transfer activities at the laboratories. It is important to note here the extreme diversity of DOE's R&D laboratories, ranging from high-security weapons laboratories, to large multipurpose laboratories, to highly specialized single-purpose laboratories.

Each laboratory has a "Cognizant Departmental Officer" for the laboratory. Against this background, we are now in the process of developing policy for technology transfer and, more specifically, developing policy and programs for implementing Section 11 of the Act which involves DOE's substantial laboratory based R&D effort. DOE is cooperating with the Federal Laboratory Consortium in the development of guidelines which can be used by the laboratories and by the user groups (particularly in State and local governments) for technology transfer. A DOE staff member is chairing a task force of member laboratory representatives and user groups which is engaged in developing these guidelines; an interim report should be available in the Fall of 1981.

DOE is in the process of coordinating an Order establishing policy and responsibility with regard to technology transfer and will provide guidelines to the R&D laboratories. That Order will include the following important elements:

- a policy requiring conduct of technology transfer programs at R&D laboratories;

- statements of responsibilities within the DOE for implementing the Act, including the Office of Energy Research, the Cognizant Departmental Officers to whom the laboratories are assigned, and the Operations Officers;

- integration of technology transfer functions into the DOE Institutional Planning Process, which will assure that technology transfer receives the appropriate recognition in organizational and institutional planning;

- a planning system for technology transfer programs based on uniform definitions and assumptions; and

- an annual report on the status and accomplishments of the technology transfer programs.

OCT 13 1981

U.S. Department of Transportation
Office of the Secretary of Transportation

400 Seventh St., S.W.
Washington, D.C. 20590

September 30, 1981

The Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
Committee on Science and Technology
U. S. House of Representatives
Washington, D. C. 20515

Dear Congressman Walgren:

I appreciated the opportunity to testify at your subcommittee hearings and am pleased to enclose the responses to your subsequent questions relating to the Department of Transportation's activities to implement the Stevenson-Wydler Technology Innovation Act.

If you have any further questions, please feel free to call me at 426-4208.

Sincerely,

Linhares

A. B. Linhares
Director
Office of Technology Sharing, I-40

Enclosure

cc: L. Verstandig, I-1

September 1981

Questions from the Subcommittee

on Science, Research and Technology

1. **The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established at each Federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office may elect to combine the Office within the existing organization.**

   (a) Please provide the Subcommittee with a list of Federal laboratories owned and funded by your agency (whether or not operated by your agency).

   (b) For each laboratory on the list described in (a) please give

   (i) the total annual budget for FY 1981

   (ii) the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applications. If the ORTA is combined with an existing organizational structure, name the structure.

ANSWER:

Listed below are the Department of Transportation Federal Laboratories, as identified by the U. S. House Subcommittee of the Appropriations Committee in 1978, and budget information for FY 1981, and an identified contact for each laboratory's technical transfer activities. The Safety Research Laboratory of the National Highway Traffic Safety Administration no longer exists.

Laboratory	FY 1981 Funding ($M)	ORTA, Contact
Transportation Systems Center (Research and Special Programs Administration) Cambridge, Massachusetts	$ 55.0	Bud Giangrande, Chief Office of Technology Sharing Transportation Systems Center Kendall Square Cambridge, Mass. 02142 (617) 494-2648

(Answer to Question 1, continued)	($M)	
Transportation Test Center (Federal Railroad Administration) Pueblo, Colorado	$ 22.0	Ed Matthews, Director Transportation Test Center Federal Railroad Administration Pueblo, Colorado 81001
Civil Aero Medical Institute (Federal Aviation Administration) Oklahoma City, Oklahoma	5.8	Dr. Evan Pickrel, Chief Biomedical and Behavioral Sciences Division Federal Aviation Administration AAM-400 Washington, D. C. 20590 (202) 426-3435
Technical Center (Federal Aviation Administration) Atlantic City, New Jersey	89.0	James Woodall, Technical Adviser FAA Technical Center Atlantic City Airport Atlantic City, N. J. 08405 (609) 641-8200
Fairbank Highway Research Center (Federal Highway Administration) McLean, Virginia	14.2	G. D. Love, Assoc. Administrator for R&D Federal Highway Administration/HRD-1 218 Fairbanks Washington, D. C. 20590 (202) 285-2051
R&D Center (U. S. Coast Guard) Groton, Connecticut	6.0	Mike D'Angelo, Asst. Director of Administration Services U.S. Coast Guard, R&D Center Avery Point Groton, Conn. 06340 (203) 445-8501
Shipboard Fire and Safety Facility (U. S. Coast Guard) Mobile, Alabama	.3	Mike D'Angelo, Asst. Director of Administration Services U.S. Coast Guard, R&D Center Avery Point Groton, Conn. 06340 (203) 445-8501
Vehicle Research and Test Center (National Highway Traffic Safety Administration) Libertyville, Ohio	2.0	Robert Carter, Director Vehicle Research and Test Center P. O. Box 37 East Liberty, Ohio 43319 (503) 666-4521

(Subcommittee Questions)

2. (a) What is your agency's total research and development budget for FY 1982 expected to be?

   (b) What is your agency's total budget for the technology transfer function, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982?

   (c) Please provide a breakdown of the technology transfer budget (as described in (b) above) into whatever detail is used to calculate it.

ANSWER:

As you are aware, the Fiscal Year 1982 budget for the Department of Transportation has as of this date not been approved by Congress. The figures are still sufficiently fluid that your questions cannot be adequately answered. When the figures are available, we will be pleased to send along the information as you have requested.

(Questions Submitted by Mr. Watkins)

QUESTION 1

There seems to be quite a misconception among the agencies as to what Congress intended when it mandated technology transfer in Section 11. Technology transfer was defined, for purposes of the Act, as the four functions listed in Section 11 (c). These functions are:

1) Preparation of application assessments for R & D projects.
2) Provide and disseminate information.
3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community.
4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

It is important to stress that "information dissemination" comprises only one-fourth of our definition of tech transfer. In fact, during the hearings from which the legislation was developed, we discovered that a number of labs and agencies were disseminating information, but very few were taking the other three steps.

Please provide for the record a breakdown of all the tech transfer activities you have cited as satisfying the requirements of the Act, and indicate into which of the four classifications each falls.

(Questions Submitted by Mr. Watkins)

(Answer to Question 1)

ANSWER

The Department of Transportation's (DOT) laboratories perform research and development activities for the Department's various modal administrations. To ensure the greatest utilization of the R&D results, the technology transfer efforts are primarily performed by those modal administrations sponsoring the R&D.

The Technology Sharing Office of the Office of the Secretary publishes a description of the various technical assistance activities of the modal administrations. The document, Technology Sharing: A Guide to Assistance in Obtaining and Using Research, Development, and Demonstration Outputs, is attached as a reference and for your information.

Listed below is a description of DOT's technology transfer activities according to the four functions listed in the act.

1) Preparation of application assessments for R&D projects.

Because transportation services in the United States are provided to the citizens by state and local governments, the research conducted by the Department has a strong utility to state and local governments. Software packages designed by the Urban Mass Transportation Administration, for example, are developed with continuous input and consultation with the primary users, local transportation entities.

The products of DOT's R&D projects are directly usable.

2) Provide and disseminate information.

The major information dissemination activities of the Department for state and local governments are performed by the following:

- Technology Sharing Office, Office of the Secretary
- Office of Development, Federal Highway Administration
- National Highway Institute, Federal Highway Administration
- Office of Engineering and Office of Traffic Operations, Federal Highway Administration
- Planning, Management and Demonstrations Office, Urban Mass Transportation Administration
- Technology, Development and Deployment Office, Urban Mass Transportation Administration
- Traffic Safety Programs, National Highway Traffic Safety Administration

(Answer to Question 1, continued)

- Research and Development Office, Federal Railroad Administration
- Office of Research and Development, United States Coast Guard
- Office of Policy, Plans and Administration, Research and Special Programs Administration.

3) Cooperate with CUFT and other technology transfer brokers to move technology from the labs to the user community.

As you are aware, the CUFT program activities are not yet underway. However, DOT has worked for some time with the National Technical Information Service in the Department of Commerce, the Federal Laboratory Consortium, and the National Innovation Network as well as the individual innovation groups located throughout the contry, as brokers, to provide pertinent information on various technologies as required by state and local governments.

DOT has also supported the brokerage activities of the Urban Consortium for Technology Initiatives, Community Technology Initiatives Program and the Urban Technology System.

The Department has an extensive field structure of individuals located throughout the country that provide assistance on transportation matters to state and local officials.

The toll free "Hotline" telephone service operated from the Transportation Systems Center in Cambridge, Massachusetts is available primarily to state and local governments for the purpose of answering their transportation queries or directing them to other specialists in DOT who can provide the needed assistance.

4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

The various demonstration projects conducted by the Department are an excellent example of getting R&D into the realm of the practical. These demonstration programs are not only conducted by DOT labs, but also by the various modal administrations.

Since the technologies developed by DOT are aimed at utilization by state and local governments, for the most part, the adaptation from "federal" to "state and local" government uses are minimized.

The Department has a very strong and active field structure. The employees of the modes, located throughout the country, are in continuous communication with state and local government.

At the Transportation Systems Center in Cambridge, Massachusetts, we provide a toll free "hotline" telephone for state and local queries.

(Questions Submitted by Mr. Watkins)

QUESTION 2

Many agencies have tended to cite as tech transfer "success stories" examples where technology found its way into the public and private sectors, but did not start out as direct tech transfer activities.

This Committee's report which accompanied the Act makes it very clear that this does not satisfy the tech transfer requirements of the Act. Let me quote from Page 32 of the Report:

> "...(T)he overriding consideration in making a determination as to what should be categorized as technology transfer is that the activity so classified should be dedicated to technology transfer from the outset (emphasis added)."

Based on that definition, how much of the tech transfer activities you've taken credit for this morning would still be considered tech transfer for the purposes of the Act?

ANSWER:

Within the Department of Transportation, are several offices that are dedicated to the function of Technology Transfer:

1. The Technology Sharing Office, Office of the Secretary
2. The Implementation Division, Federal Highway Administration
3. The Technology Sharing Office, Transportation Systems Center, Research and Special Programs Administration

Additional information on these offices and their functions is available in the document Technology Sharing: A Guide to Assistance in Obtaining and Using Research, Development and Demonstration Outputs, which was referenced in a previous answer.

(Questions Submitted by Mr. Watkins)

QUESTION 3

What is your Department doing now to promote technology transfer that it wasn't doing prior to enactment of the Stevenson-Wydler Innovation Act?

ANSWER:

With the limited financial resources at all levels of government, there is an increasing need for the sharing of information on techniques and technologies especially those that increase productivity and/or cut costs for governmental entities. Our efforts are aimed at not only producing new techniques and technologies to meet our nation's transportation problems, but to maximize utilization of these already developed that could be utilized immediately. Funding of the National Innovation Networks, and other brokerage mechanisms, for example promotes this type of horizontal technology transfer.

The current financial restraints have increased the need for our activities, and DOT is supporting this effort.

NASA
National Aeronautics and
Space Administration
Washington, D.C.
20546

August 12, 1981

Reply to Attn of: C:LVN:C-5005f

Ms. Mary Jatkowski
Subcommittee on Science,
Research and Technology
Committee on Science
and Technology
House of Representatives
Washington, DC 20515

Dear Ms. Jatkowski:

Enclosed are the responses to Chairman Walgren's and Congressman Watkins' questions from the July 16, 1981, hearing before the Subcommittee relating to the Stevenson-Wydler Technology Innovation Act.

Our records indicate that this material completes the information requested for that day.

Sincerely,

Lynne Murphy
for Terence T. Finn
Director, Office of
Legislative Affairs

Enclosures

RESPONSES TO WRITTEN QUESTIONS SUBMITTED BY CHAIRMAN WALGREN DURING THE HEARING BEFORE THE HOUSE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY ON JULY 16, 1981 TO MR. ROBERSON

QUESTION E-1:

The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established at each federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office within the existing organization.

(a) Please provide the Subcommittee with a list of federal laboratories owned and funded by your agency (whether or not operated by your agency).

(b) For each laboratory on the list described in (a) please give:
  (i) the total annual budget for FY 1981

  (ii) the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applications. If the ORTA is combined with an existing organizational structure, name the structure.

ANSWER E-1:

(a) National Aeronautics and Space Administration
Headquarters
Washington, DC

Ames Research Center
Moffett Field, CA

Hugh L. Dryden Flight Research Center
Edwards, CA

Goddard Space Flight Center
Greenbelt, MD

Jet Propulsion Laobratory
Pasadena, CA

Lyndon B. Johnson Space Center
Houston, TX

John F. Kennedy Space Center
Kennedy Space Center, FL

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL

National Space Technology Laboratories
NSTL Station, MS

Wallops Flight Center
Wallops Island, VA

Langley Research Center
Hampton, VA

Lewis Research Center
Cleveland, OH

ANSWER E-1:

(b) At NASA Field Centers, the function required of the Office of Research and Technology Applications is performed by the Technology Utilization Officer.

Ames Research Center
Moffett Field, CA 94035

FY 1981 R&D Budget: $136.7 Million
Technology Utilization Officer:
Stan Miller (415) 965-6471

Hugh L. Dryden Flight Research Center
Post Office Box 273
Edwards, CA 93523

FY 1981 R&D Budget: $18.7 Million
Chief Counsel:
John Matthews (805) 258-3311, x787

Goddard Space Flight Center
Greenbelt, MD 20771

FY 1981 R&D Budget: $563.3 Million
Technology Utilization Officer:
Donald S. Friedman (301) 344-6242

Lyndon B. Johnson Space Center
Houston, TX 77058

FY 1981 R&D Budget: $1,488.9 Million
Technology Utilization Officer:
John T. Wheeler (713) 483-3809

John F. Kennedy Space Center
Kennedy Space Center, FL 32899

FY 1981 R&D Budget: $350.3 Million
Technology Utilization Officer:
U. Reed Barnett (305) 867-3017

Langley Research Center
Langley Station
Hampton, VA 23655

FY 1981 R&D Budget: $144.8 Million
Technology Utilization and Applications Program
Officer: John Samos (804) 827-3281

Lewis Research Center
2100 Brookpark Road
Cleveland, OH 44135

FY 1981 R&D Budget: $160.7 Million
Technology Utilization Officer:
Harrison Allen, Jr. (216) 433-4000 x422

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

FY 1981 R&D Budget: $985.3 Million
Director, Technology Utilization Office:
Ismael Akbay (205) 453-2223

NASA Headquarters
400 Maryland Avenue
Washington, DC 20546

FY 1981 R&D Budget: $200 Million
Director, Technology Transfer Division:
Floyd I. Roberson (202) 755-2219

National Space Technology Laboratories
NSTL Station, MS 39529

FY 1981 R&D Budget: $7.9 Million
(No Technology Utilization Officer)

Wallops Flight Center
Wallops Island, VA 23337

FY 1981 R&D Budget: $18.5 Million
Technology Utilization Officer:
Gilmore H. Trafford (804) 824-3411 x201

Resident Office
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91103

FY 1981 R&D Budget $261.0 Million
Technology Utilization Officer:
Aubrey D. Smith (213) 354-4849

Question E-2:

(a) What is your agency's total research and development budget for FY 1982 expected to be?

(b) What is your agency's total budget for the technology transfer function, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982?

(c) Please provide a breakdown of the technology transfer budget (as described in (b) above) into whatever detail is used to calculate it.

ANSWER E-2:

(a) The total FY 1982 R&D budget request for NASA is $4,903,100,000.

(b) The technology utilization amended budget request for FY 1982 is $4.6 Million.

(c)

Dissemination & Analysis	$ 2.6 Million
Program Support & Evaluation	$ 0.5 Million
Technology Applications	$ 1.5 Million
Technology Utilization	$ 4.6 Million
Technology Transfer (Remote Sensing)	$ 0.0 Million

RESPONSES TO WRITTEN QUESTIONS SUBMITTED BY CONGRESSMAN WATKINS DURING THE HEARING BEFORE THE HOUSE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY ON JULY 16, 1981 TO MR. ROBERSON

QUESTION E-1

There seems to be quite a misconception among the agencies as to what Congress intended when it mandated technology transfer in Section 11. Technology transfer was defined, for purposes of the Act, as the four functions listed in Section 11(c). These functions are:

1) Preparation of application assessments for R&D projects.

2) Provide and disseminate information.

3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community.

4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

It is important to stress that "information dissemination" comprises only one-fourth of our definition of technology transfer. In fact, during the hearings from which the legislation was developed, we discovered that a number of labs and agencies were disseminating information, but very few were taking the other three steps.

Please provide for the record a breakdown of all the tech transfer activities you have cited as satisfying the requirements of the Act, and indicate into which of the four classifications each falls.

ANSWER E-1:

Following is a breakdown of tech transfer activities cited under the classification into which each falls.

1) Preparation of application assessments for R&D projects:

Technology Utilization - Publications Program

The basis for the technology publication effort lies with new technology reporting. NASA R&D contractors and Civil Service employees are required to report new innovations and inventions resulting from aerospace R&D on all NASA research efforts and contracts. After screening, all relevant innovations are published in abstracted form as one to two page briefs in NASA's quarterly Tech Brief Journal. This process of continuous review of all R&D

effort, and of reporting new technology is felt to be more effective than reviewing each project for potential. This approach assumes that every project has some potential technology for application.

Technology Transfer - User Requirements and Awareness Program

This program provides continuous review of users' application opportunities and review of internal programs such as Landsat, AgRISTARS and others. A single assessment and report of a review of R&D projects like Landsat does not occur, but a continuous effort to identify applications opportunities achieves the desired intent.

2) Provide and disseminate information:

Technology Utilization

The NASA Technology Utilization Program provides for dissemination and utilization of NASA developed technology. This program is managed at NASA Headquarters and implemented by Technology Utilization Officers at each NASA Field Center.

Industrial Applications Centers are centers through which industrial and other potential users may obtain scientific, technical, and management information and expertise.

State Technology Applications Centers focus on applying aerospace technology to the specific needs of state and local governments.

Computer Software Management Information Center provides aerospace developed computer programs which can be adapted to meet the needs of industry and government.

Publications: A subscriber to the NASA Tech Brief Journal, using a reader service card, can request a substantially more detailed backup report, called a Technical Support Package, for any Tech Brief which is felt to be useful or beneficial.

Technology Transfer

User Requirements and Awareness: Activities with the National Conference of State Legislatures (NCSL), the National Governors Association (NGA) and the National Association of County Officials (NACO) provide mechanisms for informing users of NASA technology opportunities.

3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community:

Technology Utilization

Terrestrial Applications: NASA undertakes to adapt existing aerospace technology to meet specified needs of other government agencies and public sector institutions, to the extent that other federal agencies co-fund projects.

Applications engineering projects are the result of a public sector problem statement developed by a NASA sponsored Application Team, or in many cases, a problem identified by another federal agency.

Technology Transfer

The project with NACO is designed to assist in program planning by aggregating the information needs of counties in the U.S. and to make those counties aware of emerging NASA space applications technology. The National Innovation Group will perform a similar regional function through workshops with municipal, county and substate regional groups primarily in the Northeast and in the West. This function has long been performed for NASA by NCSL and NGA. Similarly, cooperation with other federal agencies occurs in projects to develop the application of Landsat data. Examples are the National Park Service project, assisting states in meeting EPA water quality analysis requirements, land use planning requirements of HUD, etc.

4) Provide technical assistance to the public sector in adapting federally developed technology for practical use:

Technology Utilization - Terrestrial Applications

In January 1979, the NASA Marshall Space Flight Center delivered a lightweight firefighting module to the Coast Guard. NASA aerospace technology made possible the development of a powerful, portable, lightweight, high capacity firefighting unit for use by the U.S. Coast Guard and other shipboard or harbor firefighters. Similar cooperative projects have provided assistance in public transportation in a rapid transit cooperative project with the Department of Transportation, firefighters' breathing apparatus, etc.

Technology Transfer

Three NASA Field Centers have Regional Remote Sensing Applications Centers. These Centers, along with University based applications, and user requirements and awareness activities through organizations such as the National Conference of State Legislatures and the National Governors Association have been largely responsible for developing and transferring the technologies for remote sensing data interpretation to state and local governments and the private sector.

Our cooperative activities with the State of Iowa provide a good example of NASA's Technology Transfer projects with states. Upon the request of Iowa legislators and the Governor, NASA entered into a cooperative project for the State to assess agricultural needs and the applicability of Landsat technology to those needs.

Joint Landsat Applications projects are currently underway involving both local government and private industry.

In work related to the private sector, NASA is participating in a cooperative project with the Pacific Gas and Electric Company in California. Results of the project will be disseminated nationally by the Electric Power Research Institute.

QUESTION E-2:

Many agencies have tended to cite as tech transfer "success stories" examples where technology found its way into the public and private sectors, but did not start out as direct tech transfer activities.

This Committee's report which accompanied the Act makes it very clear that this does not satisfy the tech transfer requirements of the Act. Let me quote from Page 32 of the Report:

> ". . . (T)he overriding consideration in making a determination as to what should be categorized as technology transfer is that the activity so classified should be dedicated to technology transfer from the outset (emphasis added)."

Based on that definition, how much of the tech transfer activities you've taken credit for this morning would still be considered tech transfer for the purposes of the Act?

ANSWER E-2:

The only citation which would not meet this definition is the portion of the testimony which discussed the NASA technology used by the Ferrofluidics Corporation. In this case, Ferrofluidics Corporation used a NASA license for the technology and found applications to utilize the technology on their own. However, even in this instance, Ferrofluidics Corporation was able to capitalize on NASA's technology transfer program because of our open door policy and because we have formalized reporting procedures which facilitate our technology transfer activities.

QUESTION E-3:

What is your Department doing now to promote technology transfer that it wasn't doing prior to enactment of the Stevenson-Wydler Innovation Act?

ANSWER E-3:

Because NASA has had a viable technology transfer function for 18 years, our methods of promoting the transfer functions have remained virtually unchanged since the enactment of the Stevenson-Wydler Act.

Mr. **Walgren**. Our next panel is the Department of Defense panel, with Col. Elbert Friday, Director for Research and Technical Information, Office of the Under Secretary of Defense for Research and Engineering, U.S. Air Force; Dr. Frank Verderame, Assistant Director for Research, U.S. Army; Dr. Alan Berman, Technical Director, Naval Research Laboratory; Capt. David Parrish, Deputy Director for Laboratory Management, Naval Material Command; and Col. Tom Ferguson, Assistant Director for Laboratories, Air Force Systems Command.

[The biographical sketches of Colonel Friday, Dr. Alan Berman, Captain Parrish, and Colonel Ferguson follow:]

BIOGRAPHICAL SKETCH

Elbert W. Friday Jr., Colonel, USAF

Present Position:	Director, Research and Technical Information, Office of the Under Secretary of Defense for Research and Engineering
Education:	BS, Engineering Physics, University of Oklahoma 1961 PhD, Meteorology, University of Oklahoma 1969
Experience:	Director, Environmental and Life Sciences, Office of the Under Secretary of Defense for Research and Engineering, 1978-1981 Various staff and command assignments with the Air Weather Service, USAF, 1961-1977
Professional:	American Meteorlogical Society American Association for Advancement of Sciences Sigma Xi National Weather Association American Defense Preparedness Association
Personal:	DOB: 13 July 1939 POB: De Queen, Arkansas Married, 2 children

BIOGRAPHICAL SKETCH
ON
DR. ALAN BERMAN

Dr. Berman was born in Brooklyn, New York, on 2 November 1925. He received the A.B. degree in physics from Columbia College in 1947 and the Ph.D. degree in physics from Columbia University in 1952.

In 1952 he began his professional career as a research scientist at the Hudson Laboratories of Columbia University. He became Assistant Director of Hudson Laboratories in 1955, Associate Director in 1957, and Director in 1963. Dr. Berman became Director of Research for the Naval Research Laboratory in May 1967.

Dr. Berman's personal research specialties include the areas of underwater acoustics, oceanography, and signal processing. He has published numerous papers on these and related subjects, and has served on many Navy and national-level advisory groups. In addition to providing consultative services for a number of Department of Defense and other Government agencies, he has led several interagency study groups and has served as a consultant to the National Security Council and the Office of Science and Technology Policy.

Dr. Berman has on three occasions served as a visiting scientist at the Admiralty Research Laboratory, Teddington, England (1955, 1957, 1960), and once at the SACLANT ASW Research Center, La Specia, Italy (1960). He is a fellow of the American Physical Society and the Acoustical Society of America, and is a member of the American Institute of Physics and Sigma Xi.

In 1969, Dr. Berman was awarded the Department of the Navy Superior Civilian Service Award. In 1973 he received the Department of Defense Distinguished Civilian Service Award, and in 1977 he received a personal letter of commendation from President Ford for his services as a technical advisor to the National Security Council. He is a charter member of the Senior Executive Service, and in September 1980 he was designated with the rank of Distinguished Senior Executive.

In 1980, Dr. Berman received an award from Mayor William Hanna of Rockville, Maryland. On behalf of the American League of Mayors, the award was presented to Dr. Berman in appreciation of his efforts to transfer knowledge and technology to local governments across the nation, thereby enhancing their productivity and service delivery capability.

Dr. Berman and his wife Charlotte live in Alexandria, Virginia. They have three daughters and two sons.

CAPTAIN DAVID F. PARRISH, USN

CAPT Parrish graduated from Miami University (Ohio) in 1958 with a degree in English Literature. Upon commissioning, he reported to USS Lansing (DER-388) in Pearl Harbor. While in Lansing, CAPT Parrish participated in some of the last above-ground nuclear tests at Johnson Island and patrolled the DEW (distant early warning) line. In 1960 he attended submarine school and was assigned to USS Cobbler (SS-344) in Norfolk. After three years in Cobbler, he was assigned to the Naval Postgraduate School at Monterey where he received a degree in Electrical Engineering. His next assignment was back in Pearl Harbor aboard the USS Blackfin (SS-322) and 18 months later he was assigned to the staff of the Commander Submarine Force Pacific where he served as a Command Center watch officer. In 1969 he was assigned as Executive Officer of USS Bonefish (SS-582), also in Pearl Harbor. In 1971, CAPT Parrish attended Armed Forces Staff College and, upon completion, assumed command of USS Gudgeon (SS-567) in San Diego. In the Fall of 1973, he reported to Commander Sixth Fleet where he served as the staff submarine officer. His next tour brought him to Washington where he was assigned to the Sea Control Planning Division in OP-095. Following three years on OPNAV staff, CAPT Parrish was assigned to PM-4 where he served as the submarine fleet readiness officer. In August of 1979 he reported to the National Defense University where he attended the Industrial College. During this tour, he concurrently attended George Washington University where he was awarded a Master's degree in Public Administration. Upon graduation, he reported as Deputy Director of Navy Laboratories.

Effective 1 December 1980, CAPT Parrish assumed the duties of Assistant Deputy Chief of Naval Material (Laboratory Management)/Director of Laboratory Programs.

BIOGRAPHY
United States Air Force

OFFICE OF INFORMATION, AIR FORCE SYSTEMS COMMAND, ANDREWS AFB, MD. 20334

COLONEL THOMAS R. FERGUSON, JR.

Col. Thomas R. Ferguson Jr. is Deputy Director of Science and Technology at Headquarters Air Force Systems Command, Andrews AFB, Md.

He was born in Cleveland, Ohio, on August 26, 1935. After several family moves to New Jersey and Texas, he completed high school in Clarksburg, W. Va. His undergraduate degree was earned at West Virginia University in Chemical Engineering.

After one year of employment with the Dupont Company, he entered active duty in July 1958. He received flight training at Moore AB, Tex., and Vance AFB, Okla., with initial assignment to the 77th Bomb Squadron, 28th Bomb Wing, at Ellsworth AFB, S.D., in September 1959.

He served continuously as a B-52 crew member until June 1966. During this interval, he performed as copilot with standardization duties, aircraft commander and instructor pilot. His last B-52 missions were flown from Guam in support of Southeast Asia operations.

He was assigned to Air University, Air Force Institute of Technology, with duty at Ohio State University where he received a master of science degree in metallurgical engineering in June 1968.

Following graduation, he was assigned to 7th Air Force Headquarters at Tan Son Nhut AB, Republic of Vietnam, where he served in the "outcountry" command post, Blue Chip, as a launch control officer and as the operations briefing officer to the commander and his staff.

He was transferred to AFSC, Air Force Materials Laboratory, Wright-Patterson AFB, Ohio, in August 1969 where he served as technical manager for materials engineers supporting major system program offices and as assistant division chief,

(MORE)

Systems Support Division. In 1973, Colonel Ferguson was assigned to Headquarters U. S. Air Force in the Pentagon for duty in the Science and Technology Division, Deputy Chief of Staff, Research and Development, as program element monitor for programs of several laboratories.

In 1976, Colonel Ferguson was assigned to Headquarters Air Force Systems Command in the Directorate of Science and Technology as chief, Flight Vehicle Division and later as chief, Avionics and Weapons Division.

After graduation from the Industrial College of the Armed Forces in June 1979, he was reassigned to Headquarters AFSC as deputy to the Director of Science and Technology.

Colonel Ferguson is a command pilot and has also completed Squadron Officers School and Air Command and Staff College. Decorations include Legion of Merit, Air Medal, Meritorious Service Medal and Air Force Commendation Medal.

He was promoted to the grade of colonel with date of rank of August 30, 1977.

He is married to the former Mary Bird Carder of Clarksburg, W. Va. They have a son, Ritson, and daughter, Elizabeth.

TESTIMONY OF COL. ELBERT FRIDAY, DIRECTOR FOR RESEARCH AND TECHNICAL INFORMATION, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING, U.S. AIR FORCE; DR. FRANK VERDERAME, ASSISTANT DIRECTOR FOR RESEARCH, U.S. ARMY; DR. ALAN BERMAN, TECHNICAL DIRECTOR, NAVAL RESEARCH LABORATORY; CAPT. DAVID PARRISH, DEPUTY DIRECTOR FOR LABORATORY MANAGEMENT, NAVAL MATERIAL COMMAND; AND COL. TOM FERGUSON, ASSISTANT DIRECTOR FOR LABORATORIES, AIR FORCE SYSTEMS COMMAND

Colonel FRIDAY. I want to assure you that we in the Department of Defense consider this vital to the increased growth and strength of our Nation. I think as the panelists before indicated to you today, I think we also have a long history in technology transfer that we, too, can be proud of, transferring technology from our laboratories to the nonmilitary sector. We established mechanisms for encouraging transfer long before the passage of the act. The present Laboratory Consortium was an outgrowth of a DOD program initiated several years ago. All levels of DOD management support the broadest application of research within the legal constraints under which we must operate.

We have taken two distinct actions with respect to the Stevenson-Wydler Act of last year. First, the Secretary of Defense has exercised a waiver of the specific funding and personnel requirements in section 11. This is not meant to signify DOD's lack of support. As Mr. Carlucci said to the House concerning the waiver, DOD substantially complies with the requirements of the act at the present time.

The bulk of the $16 billion R. & D. appropriation however, is for the most part major systems development, including the major strategic programs so vital to the future national security. The science and technology portions of the DOD research and development budget, the laboratory budget, amounts to $3 billion in fiscal year 1981, and about $3½ billion in 1982. It is this program which provides the technology options for the future.

DOD technology transfer activities are not and cannot be usefully and effectively distributed through the laboratory system. Consequently, the assignment of one professional at each DOD laboratory which exceeds the threshhold established in section 11 would be impractical. Some laboratories have more than one full-time professional staff member assigned to this task. We are in the process of creating the ORTA's at each and every one of our laboratories within the Department.

DOD has a very active and aggressive information transfer function. For the past 3 years, we have averaged over 16,000 new documents, technical documents being transferred to the National Technical Information Service of the Department of Commerce. This represents 52 percent of DOD's total technical documents transferred to the Defense Technical Information Center.

Those documents don't simply reside at NTIS, however. In last fiscal year, they sold 185,000 copies of those technical documents.

The second major action at the Office of the Secretary of Defense was taken by the Under Secretary for Research last month. He has conveyed the requirements of the Stevenson-Wydler Act to the services and asked each service to establish the mechanism to comply with the law. In doing so, we recognize the continuing responsibility of the Federal Government in general and the Department of Defense in particular, to insure the maximum transfer of the results of our research investment to the public and private sectors. Such transfer taken within the proper framework of national security considerations should assist in our overall goals of national modernization and increased productivity.

Rebuilding our military technological base demands technological innovation. We must apply technology wherever it can be found and reduce the barriers to transfer of information in ways that are consistent with our national security requirements.

The Department of Defense through the military departments and their laboratories has a good record in technology transfer. We are committed to continued efforts in this area and will provide the policy guidance necessary to achieve the desired results.

The services are represented here today and each in turn will present their response to the Stevenson-Wydler bill.

[The prepared statement of Colonel Friday follows:]

THE DEPARTMENT OF DEFENSE

RESPONSE TO

THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980,

P.L. 96-480

STATEMENT BY
COLONEL ELBERT W. FRIDAY, JR.
ACTING DIRECTOR, RESEARCH AND TECHNICAL INFORMATION
OFFICE OF THE UNDER SECRETARY OF DEFENSE
FOR
RESEARCH AND ENGINEERING

BEFORE THE
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
OF THE
COMMITTEE FOR SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
THE 97TH CONGRESS, FIRST SESSION

16 JULY 1981

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I AM PLEASED TO HAVE THE OPPORTUNITY TO DESCRIBE BRIEFLY THE DEPARTMENT OF DEFENSE RESPONSE TO PL 96-480, THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980.

TECHNOLOGY TRANSFER IS VIEWED MORE BROADLY IN THE DEPARTMENT OF DEFENSE THAN IT IS IN OTHER FEDERAL AGENCIES. THERE IS THE VITAL THREE-CORNERED PARTNERSHIP AMONG UNIVERSITIES, THE DOD IN-HOUSE LABORATORIES, AND INDUSTRY THAT PROVIDES THE WEAPONS TECHNOLOGY FOR OUR MILITARY FORCES. FOR MANY YEARS THE LABORATORIES OF THE DEPARTMENT OF DEFENSE HAVE BEEN COOPERATING WITH LOCAL AND STATE GOVERNMENT TO TRANSFER MILITARY TECHNOLOGY TO AID IN THE SOLUTION OF PROBLEMS IN THE CIVIL SECTOR. MUCH MILITARY TECHNOLOGY FINDS ITS WAY INTO THE THE COMPETITIVE CIVILIAN ECONOMY THROUGH THE NORMAL PROCESSES OF OUR FREE ENTERPRISE SYSTEM BECAUSE MORE THAN HALF OF OUR MILITARY SCIENCE AND TECHNOLOGY IS PERFORMED BY PRIVATE INDUSTRIAL CORPORATIONS.

AT THE SAME TIME WE MUST KEEP IN MIND WHY WE SPEND MORE THAN THREE BILLION DOLLARS A YEAR DEVELOPING MILITARY TECHNOLOGY. THE SOVIETS OUTNUMBER US IN ALMOST EVERY CATEGORY OF MODERN MILITARY EQUIPMENT. IF WE WERE TO ATTEMPT TO MATCH THEM IN EACH CATEGORY, NOT ONLY WOULD WE NEED TO GREATLY INCREASE OUR DEFENSE BUDGET, WE WOULD ALSO HAVE TO GREATLY INCREASE OUR STANDING MILITARY FORCES. INSTEAD WE HAVE ELECTED TO USE TECHNICAL SUPERIORITY TO OFFSET THE SOVIET'S NUMERICAL SUPERIORITY.

THIS MEANS WE MUST NOT ONLY GENERATE TECHNOLOGY AT A RAPID RATE, WE MUST ALSO HAVE PRUDENT PROCEDURES TO SAFEGUARD TECHNOLOGY WHICH IS CRITICAL TO OUR NATIONAL DEFENSE POSTURE.

AS WE DISCUSS THIS TOPIC I REQUEST THAT YOU KEEP IN MIND THE TWIN RESPONSIBILITIES THAT THE DoD HAS IN TECHNOLOGY TRANSFER: TO STIMULATE APPLICATION AND TO PROTECT SENSITIVE KNOWLEDGE.

ON 21 OCTOBER 1980, PL 96-480, THE STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980, WAS SIGNED INTO LAW. THE PURPOSE OF THE ACT WAS, AMONG OTHER THINGS, TO STIMULATE IMPROVED USE BY THE STATE, LOCAL AND PRIVATE SECTORS OF FEDERALLY FUNDED TECHNOLOGY DEVELOPMENTS. SECTION 11 OF PL 96-480 REQUIRES THAT EACH FEDERAL LABORATORY MUST HAVE AN OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA) TO FACILITATE THE TRANSFER OF FEDERAL TECHNOLOGY TO THE STATE, LOCAL AND PRIVATE SECTOR USERS. THIS SECTION ALSO REQUIRES EACH LABORATORY ASSIGN AT LEAST ONE FULL TIME PROFESSIONAL TO THIS OFFICE AND DEVOTE A MINIMUM OF ONE HALF OF ONE PERCENT OF THE AGENCY'S R&D BUDGET TO SUPPORT TECHNOLOGY TRANSFER.

THE STEVENSON-WYDLER ACT PROMOTES TECHNOLOGICAL INNOVATION IN THE UNITED STATES, BUT STRICT COMPLIANCE WITH ITS PROVISIONS FOR DIVERSION OF BUDGETED FUNDS CAN BE WAIVED BY THE AGENCY HEAD. SUCH A WAIVER HAS BEEN EXERCISED BY THE SECRETARY OF DEFENSE.

IN EXPLAINING HIS REASONS FOR WAIVING THE SPECIFIC TECHNOLOGY TRANSFER STAFFING AND FUNDING REQUIREMENTS OF THE STEVENSON-WYDLER ACT, THE SECRETARY OF DEFENSE TOOK ACCOUNT OF TECHNOLOGY TRANSFER ACTIVITIES ALREADY PROMOTED BY THE DEPARTMENT ALONG WITH ESTIMATES OF THE MANPOWER AND FISCAL RESOURCES THAT ARE DEVOTED TO THEM.

Among the points considered by the Secretary were:

o The current activity of DoD in technology transfer substantially achieves the objectives of the Act without formally meeting the budgetary and staffing requirements as expressed in the language of the Act.

o R&D activities within the research, development, test and evaluation budget involve substantial classified and national defense-oriented efforts that are inappropriate for transfer to the civil sector.

o DoD technology transfer activities are not, and cannot be uniformly and effectively distributed throughout the DoD laboratory system. Consequently, the assignment of one professional at each of 57 DoD laboratories would be impractical. (It should be noted that current DoD technology transfer activities involve approximately 700 professional staff years of effort.)

o Meeting the requirements of Section 11 of the Act could prove to be a serious management burden on the Department of Defense, and could also interface with the R&D process in our primary mission of national defense.

In granting the waiver the Secretary noted that his action was also consistent with the goal of reducing the Federal bureaucracy. In a letter to the President of the Senate and the Speaker of the House of Representatives, Deputy Secretary Carlucci reaffirmed that the Department of Defense agrees that it should be part of the mission of DoD laboratories to identify and aid in applying technology of potential value to the civilian sector.

SUBSEQUENTLY, THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING HAS FORMALLY CONVEYED THE REQUIREMENTS OF THE STEVENSON-WYDLER ACT TO THE SERVICES. HE HAS ASKED EACH SERVICE TO ESTABLISH A MECHANISM TO COMPLY WITH THE LAW. IN DOING SO, HE RECOGNIZES THE CONTINUING RESPONSIBILITY OF THE FEDERAL GOVERNMENT IN GENERAL, AND THE DEPARTMENT OF DEFENSE IN PARTICULAR, TO ENSURE THE MAXIMUM TRANSFER OF THE RESULTS OF OUR RESEARCH INVESTMENT TO THE PUBLIC AND PRIVATE SECTORS OF THIS COUNTRY. SUCH TRANSFER, TAKEN WITHIN THE PROPER FRAMEWORK OF NATIONAL SECURITY CONSIDERATION, SHOULD ASSIST IN OUR OVERALL GOALS OF NATIONAL MODERNIZATION AND INCREASED PRODUCTIVITY. COPIES OF APPROPRIATE MEMORANDA ARE ATTACHED.

REBUILDING OUR MILITARY TECHNOLOGICAL BASE DEMANDS TECHNOLOGICAL INNOVATION. WE MUST APPLY TECHNOLOGY WHEREVER IT CAN BE FOUND. WE MUST REDUCE THE BARRIERS TO TRANSFER OF INFORMATION IN WAYS THAT ARE CONSISTANT WITH OUR NATIONAL SECURITY REQUIREMENTS. THE DEPARTMENT OF DEFENSE THROUGH THE MILITARY DEPARTMENTS AND THEIR LABORATORIES HAS A GOOD RECORD IN TECHNOLOGY TRANSFER. WE ARE COMMITTED TO CONTINUED EFFORTS IN THIS AREA AND WILL PROVIDE THE POLICY GUIDANCE NECESSARY TO ACHIEVE THE DESIRED RESULTS.

ARE THERE ANY QUESTIONS?

THE UNDER SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

RESEARCH AND
ENGINEERING

26 JUN 1981

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (RESEARCH, DEVELOPMENT AND ACQUISITION)
ASSISTANT SECRETARY OF THE NAVY (RESEARCH, ENGINEERING AND SYSTEMS)
ASSISTANT SECRETARY OF THE AIR FORCE (RESEARCH, DEVELOPMENT AND LOGISTICS)

SUBJECT: Compliance with the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480)

Section 11 of the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) is intended to facilitate the transfer of Federal technology to state and local governments and the private sector. It contains provisions which require action by your organization. A copy of the Act is attached at Tab A.

The Act requires each Federal laboratory to have an Office of Research and Technology Applications (ORTA). It further specifies explicit funding and personnel requirements for the ORTA function. The funding and personnel requirements can be waived by an agency, and the Department of Defense has exercised this option (Attachment B). However, the requirement for an ORTA may not be waived. Each of you should establish the necessary mechanism within your Services for complying with the law.

I recognize the continuing responsibility for the Federal Government in general, and the Department of Defense in particular, to ensure the maximum transfer of the results of our research investment to the public and private sectors of this country. Such transfer, taken within the proper framework of national security considerations, should assist in our overall goals of national modernization and increased productivity.

My point of contact for this action is Colonel Elbert W. Friday, Jr., Director, Office of Research and Technical Information, phone 697-3228. Please provide him a contact officer in your Service by 10 July to enable us to develop methods of compliance with P.L. 96-480 which will satisfy the spirit of technology transfer without generating an unnecessary bureaucratic structure.

James P. Wade Jr
f. Richard D. DeLauer

Attachments

THE SECRETARY OF DEFENSE
WASHINGTON, D.C. [illegible]

FEB [illegible] 1981

Honorable Thomas P. O'Neill, Jr.
Speaker of the House
  of Representatives
Washington, D. C.   20515

Dear Mr. Speaker:

This letter is in reference to Section 11 of Public Law 96-480, the Stevenson-Wydler Technology Innovation Act of 1980, that, among other things, requires:

- An Office of Research and Technology Applications (ORTA) in each laboratory with an annual budget exceeding $20 million, to be staffed with at least one full-time professional.
- Each federal agency, beginning in FY 82, must devote a minimum of one-half percent of the agency's R&D budget to support technology transfer, including support of the ORTAs.

As permitted by the same section of the Act, I am waiving these requirements because:

- The current activity of DoD in technology transfer substantially achieves the objectives of PL 96-480, without formally meeting the budgetary and staffing requirements as expressed in the language of the Act.
- R&D activities within the Research, Development, Test and Evaluation budget involve substantial classified and national defense-oriented efforts, that are inappropriate for transfer to the civil sector.
- DoD technology transfer activities are not, and cannot be, uniformly and effectively distributed throughout the DoD laboratory system. Consequently, the assignment of one professional for an ORTA at each of 57 DoD laboratories would be impractical. (It should be noted that current DoD technology transfer activities involve approximately 700 professional man-years of effort.)

TAB B

- Meeting the above Section II requirements could prove to be a serious management burden on the Department of Defense, and could also interfere with the R&E process in our primary mission of national defense.

The Department of Defense agrees that it should be part of the mission of DoD laboratories to identify and aid in applying technology of potential value to the civilian sector. Defense technology is made available to the civilian sector through a number of technical information and technology transfer activities. The approximate level of DoD funding and professional manpower invested in these activities is shown in Enclosure (1). As is apparent, the current scope and size of DoD technical information and technology transfer activities are very close to those set forth in the Act, and it is our intention to continue our vigorous support of these activities in the future.

A definite benefit of our method of implementation is that this action is committed to reducing, rather than augmenting, the size of the Federal bureaucracy; to attempt to live up to a literal interpretation of PL 96-480 would go counter to this intent.

It is relevant to note that the Federal Laboratory Consortium for Technology Transfer evolved from a DoD precursor. DoD involvement in the Consortium has been maintained at a high level through the participation of numerous DoD laboratories in Consortium activities. Enclosure (2) is a copy of a report made earlier to the Committee on Appropriations of the United States Senate concerning DoD and the Federal Laboratory Consortium.

I trust that you agree that this waiver is entirely appropriate.

Sincerely,

Frank C. Carlucci
Deputy Secretary of Defense

Enclosures

DOD TECHNOLOGY TRANSFER ACTIVITIES

	Activity	$(M)/yr	Prof. MY
1.	Army Corps of Engineers (STINFO)	3.3	99[a]
2.	Defense Technical Information Center	14.5	84[b]
3.	Information Analysis Centers	8.0	19
4.	Navy Technical Information/Technology Transfer	1.0	6
5.	Army Technical Information/Technology Transfer	5.5	182[d]
6.	Air Force Technical Information/ Technology Transfer	8.0	70[d]
7.	DoD Lab. manpower for technology transfer and the Federal Laboratory Consortium	1.5[e]	18
8.	DoD Manufacturing Technology Program (3% of $151M)	4.5	6
9.	Patent licensing programs (3 Services)	0.3	1
10.	Government/Industry Data Exchange Program	1.9	32
11.	Tri-Services Industry Information Offices	0.6	incl. in 5 & 6
12.	Potential contractor agreements (Navy NICRAD 60/yr)	0.3	11
13.	Projects for State and local governments (gratis)	0.3	5
14.	Navy non-DoD funded technology transfer projects	N/A	220[c]
	TOTAL	49.7	742

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[a] Scientific and Technical Information (STINFO) only.

[b] 90 authorized.

[c] Dollars and manpower for Army and Air Force non-DoD funded technology transfer projects unavailable at this time.

[d] Includes Items 11 & 12.

[e] The Federal Laboratory Consortium for Technology Transfer was started by a small group of DoD laboratories in 1971.

Enclosure (1)

January 1979

REPORT BY THE DEPARTMENT OF DEFENSE
TO THE COMMITTEE ON APPROPRIATIONS
UNITED STATES SENATE

ACTIVITIES OF THE DEPARTMENT OF DEFENSE IN THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

The Committee for Appropriations, United States Senate requested the Department of Defense to submit a brief report on Department of Defense activities in the Federal Laboratory Consortium for Technology Transfer. The request was made on page 34 of Committee Report No. 95-1264, Department of Defense Appropriations Bill, 1979 which reads as follows:

> The Committee is aware that the Department was instrumental in establishing a technology transfer consortium which is now known as the Federal Laboratory Consortium. This consortium of Federal laboratories provides technical assistance to State and local officials and facilitates the transfer of research and technology developed in Federal laboratories to the public sector. The current Department policy to authorize any one of its laboratories to expend up to 3 percent of its professional man-years for this technology transfer effort is important. The Committee desires this effort with State and local governments to continue and requests that the Department provide the Committee a brief summary of their activities in this area by January 31, 1979.

Research and development conducted and sponsored by the Department of Defense has over the years resulted in very significant transfer of technology to the domestic sector. The Department of Defense has long recognized that technology and products originally developed for military use also have potential for application in the U.S. domestic sector. Technology transfer to the private sector has been particularly successful because about 75 percent of the Department's research and development and practically all production is performed by a broad base of university and industrial organizations. This assures that the results of Department of Defense programs are in the commercial domain which is best equipped for adapting technology and products to meaningful civil uses. The process is further enhanced because the in-house/university/industry development efforts span a spectrum of activity ranging from new concepts to useful end products. This team effort has worked over a number of years and permits greater and wider use of the Department's developed or sponsored research and development.

Technology transfer in the context of this report is the beneficial use of technology in applications other than those for which the technology was originally developed. It is sometimes referred to as "secondary" or "spinoff" technology. The application of federally developed technology to the solution of domestic problems has been established as a national and Department of Defense objective by the following actions.

- Secretary of Defense participation in the Domestic Action Council.
- The President's March 1972 message to Congress on Science and Technology.
- A General Accounting Office report on the use of Department of Defense laboratories for domestic technology transfer.

- The National Science and Technology Policy, Organization and Priorities Act of 1976.
- Increasing emphasis by user groups in the application of federally developed technology to meet their specific needs.
- Continued interest by members of Congress.

In 1971, 11 in-house Department of Defense facilities joined together to form the DoD Technology Transfer Consortium in an effort to improve domestic technology transfer processes. The goal was to establish technology transfer points-of-contact at each research and development activity and thus form a person-to-person network to facilitate the flow and application of technology from Department of Defense laboratories to the solution of domestic problems. Since 1971, the Department and the National Science Foundation have banded together to promote and stimulate technology through these linkages and the Department of Defense Consortium has been expanded into a Federal Laboratory Consortium for Technology Transfer. Consortium membership has grown to about 180 Federal laboratories and centers representing not only the Department of Defense, but also the Commerce, Transportation, Justice, Energy, Health, Education and Welfare Departments and the National Aeronautics and Space Administration. Department of Defense participation has grown to 45 installations and continued close linkage is maintained with the National Science Foundation, home of the Consortium.

The National Science Foundation has provided the Consortium an organizational base, administrative capability and programmatic support as part of the National Science Foundation's Division of Intergovernmental

Science and Public Technology Program. The Department of Defense has provided a program manager for the Federal program over the past six years. Mr. Harold Metcalf of the Naval Weapons Center, Mr. Joseph Antinucci of the Naval Underwater Systems Center and Mr. Nicholas Montanarelli of the Army Chemical Systems Laboratory have served successively as Program Managers in the National Science Foundation for approximately two years each. Currently, Mr. Cortland Dugger of the Air Force Systems Command and Mr. John McFall of the National Aeronautics and Space Administration are serving in that capacity.

An important milestone was the establishment of a Secretariat to service the Consortium in the achievement of its goals. The Secretariat is provided by the Technology Transfer Office of the Naval Weapons Center with National Science Foundation funding support. The Secretariat supports the Consortium Program Managers by planning, organizing and developing the capacity of the Consortium to meet national objectives and operational support advice to members. Mr. George Lindsteadt of the Naval Weapons Center serves as the Chairman of the Consortium and his activity has been a significant factor in achieving Consortium goals.

Department of Defense participants in the Consortium have assisted state and local governments in areas of transportation, public safety, economic development, energy, public works, environmental improvement and community development. These contributions have come about primarily as a result of the active nature of the Consortium which emphasizes the transfer and adaptation of technology through person-to-person mechanisms via both individual and cooperative efforts of laboratories and centers. Among the achievements of the Department in the Consortium are state and local government activities that includes:

- Technical support to the Southwest Innovation Group, New England Innovation Group, Georgia Innovation Group, Oklahoma Innovation Group and other public networks.
- Maintains liaison with the U.S. Conference of Mayors, National League of Cities, the National Conference of State Legislatures and other public interest groups.
- Support of state and local governments through the Intergovernmental Personnel Act.
- Improved monitoring and dispensing of fuel for the New York City Police Department.
- Transfer of soft body-armor technology to the law enforcement sector.
- Transfer of night vision technology to law enforcement agencies, border security functions and numerous other applications.
- Conduct a water purification project to remove asbestos fibers from Lake Superior.
- Provided advice on the selection of hydraulic fluids for use in vehicles in water saturated areas.
- Assessed fire alarm options for a city.
- Provided instrumentation for a solar energy demonstration project.

- Assisted in the development of energy conservation in public buildings.
- Developed field measurement techniques for determining potential aerosol hazards of sprinkler irrigation systems.
- Assisted in the design of disaster alarm systems.

There appears to be a consensus that the person-to-person linkage provided by the Consortium has been most useful in strengthening technology transfer activities. It is clear that the Consortium, with a relatively small investment of resources, has been useful in increasing the national utility of Federal laboratory products and processes. In view of this, the Department of Defense, on 12 June 1978, restated its strong endorsement of the Consortium and extended its participation with the National Science Foundation through FY 1980. It is our view that the activities of Defense organizations in the Consortium are an important step toward achieving national goals expressed by the Congress and the Executive Branch in the area of domestic technology transfer.

Attachments 3
1 - DoD Memorandum, 22 June 1978
2 - Operating Policy
3 - Directory of Federal Technology Transfer

Not retained

Mr. Ertel. Thank you very much, Colonel Friday.

Dr. Verderame? We will go through the entire testimony and come back for the questions.

Dr. Verderame. Thank you, Mr. Chairman. It is an honor to be here before you to represent the Army and to discuss our implementation of the Stevenson-Wydler Act of 1980.

I will briefly summarize for you present Army activities which were begun well before the enactment of Public Law 96-480 and then I will point out future actions we will take to comply with the spirit and the intent of the act.

To cover present Army activities, I would like to emphasize that the bulk of our present technology transfer activity is done by Army representatives, who are in place at the laboratories and act through the Federal Laboratory Consortium. Twenty-three Army laboratories with R. & D. budgets in excess of $20 million, are served by 21 members of the Consortium. Thirteen of these laboratories have active Federal Laboratory Consortium offices within the laboratory. Eight others have offices within their command headquarters.

The Materials Development and Readiness Command, the Medical R. & D. Command, and the Corps of Engineers have been very active in assessing the new developments in their laboratories and disseminating such information to the private sector.

All of these activities are governed by Army regulation 70-57, which dates back to 1975 and is in keeping with the spirit of Stevenson-Wydler.

The list of success stories for the transfer of technology from the Army to the public sector is very long.

For example, the Corps of Engineers has an energy analysis computer program called the building loads analysis system thermodynamics [BLAST] that is used to predict energy requirements in buildings and facilities. This program was developed to satisfy Army and Air Force needs in developing energy efficient new facilities and for retrofitting existing facilities to reduce energy costs. The program was subsequently made available at no cost to the general public and was adopted by several commercial computer service organizations. BLAST is now being used by architects and engineers throughout the country.

The Medical Research and Development Command has contributed a great deal to improve medical care in this country. Most recently, Army research has developed an antibotulism serum. They have also developed a vaccine against Venezuelan equine encephalitis which is extensively used in America today.

The Materials Development and Readiness Command has developed many, many innovations which are in general use. One of their predecessors, the old Army Ordnance Corps spearheaded the invention and development of the very first computer made at the University of Pennsylvania under Army contract. Today we are making body armor for executives. Countless developments in the future will be actively transferred to local governments and industry.

Hany Diamond Labs is typical of the Army laboratories. This laboratory expends about 3 to 5 years, man-years, of effort in actively disseminating new knowledge gained by the laboratory.

Our Office of Army Research in North Carolina has a three-man office which maintains contact with institutions to transfer new information resulting from basic research.

Let me now go to what we are going to do in the future to implement the spirit and the intent of the Stevenson-Wydler Act.

We have in hand the directive from USDRE. This is the OSD office that Colonel Friday represents. We will implement that directive. The Corps of Engineers has provided us with a model for the rest of the Army to follow. The present Army members of the Federal Laboratory Consortium, who are by inclination and by experience best suited to implement this action will form the basis for the Army technology transfer activities. We will have an Office for Research and Technology Applications or its equivalent at each laboratory that will have the functions outlined in the Stevenson-Wydler Act.

Finally Army regulation 70-57, which I mentioned before, is now being reviewed to reflect the new parts of the Stevenson-Wydler Act.

I have Col. Max Kovel of the Corps of Engineers and also Cliff Lanham, from the Hany Diamond Laboratories. Together, we are prepared to answer any questions you might have.

[The prepared statement of Dr. Verderame follows:]

Mr. Chairman and members of the subcommittee; I am glad to come before you today to briefly review current Army Technology Transfer Activities and to inform you of the Army's plans for the implementation of Section II of the Stevenson-Wydler Technology Innovation Act of 1980, as well as our commitment to the spirit of this law. In that spirit I assure you the Army will seek to develop more efficient and effective means to transfer appropriate Army developed technology to State and local governments and the private sector, within the limits imposed by its vital defense mission.

Throughout much of its history the Army has provided aid to State and local governments, and contributed numerous technological innovations of subsequent importance to the civil sector. In the current economic environment, however, we have recognized the increased importance of our continuing efforts to insure the maximum transfer of the results of our research investment to the public and private sectors. To this end, the Army currently supports a number of active mechanisms for accomplishing this transfer including cooperation with civil sector agencies, both public and private, various exchanges with colleges and universities, presentations of new technical developments at professional society meetings and the participation of many Army laboratories in the Federal Laboratory Consortium for Technology Transfer (FLC). Since July 1976, the Army has had a written policy (AR 70-57) supporting military-civilian technology transfer which specifically emphasizes State and local government, provides guidance for Army laboratories to participate in the FLC and requires each laboratory to provide an annual report of accomplishments. there are currently 22 representatives of Army laboratories or groups of laboratories in the Consortium with many taking an active role in consortium management.

Now with the policy recently stated by Congress and with the coordination of DoD, the Army management under this new administration is revising regulations and developing plans to meet the objectives of Section II of Pub. Law 96-480. In accordance with the law it is our intent to establish a staff level Office of Research and Technology Applications (ORTA) in the organization of each laboratory and appropriate R&D activity to perform the specified functions. In each case, a specific individual professional will be identified to be responsible on a full or part time basis, as appropriate for carrying out the ORTA functions and for participating in the longer term development of regulations for the optimum integration of these functions into the Army R&D structure. Further, each laboratory will be directed to assess their products for applicability to the civiliam community and will be strongly encouraged to participate in the Federal Laboratory Consortium with the responsible professional serving as the representative of the laboratory. Most of the laboratories are already doing these functions, but we are stressing total Army laboratory participation. They will also be encouraged to establish relations with other recognized organizations that act as links between Federal R&D resources and potential uses. The level of effort needed to accomplish this mission will be left, at least initially, to the discretion of the directors of the respective organizations, with progress being reviewed by my office as part of the annual reporting process. However, they will be precluded from doing work which will interfere with the laboratories performance of the primary mission.

The Department of Defense has with good reason waived the specific staffing and funding requirements of the law. The Army, which has the largest number and possibly the most diverse group of R&D activities of all of the Services, particularly appreciates the flexibility provided by this option. the unquestioned importance of the national defense mission, the need to protect sensitive technical information, and, even the extent of the Army R&D organization which makes it such a significant resource for the purposes discussed here, dictate that we take care to put a transfer system in place which will not build a new bureaucratic structure but will truly maximize our use of federal resources. The Army will strive to accomplish this task in as timely a manner as possible.

Are there any questions?

Mr. **Ertel**. Our next witness is Dr. Alan Berman, technical director at the Naval Research Laboratory.

Dr. **Berman**. Mr. Chairman, the relevant documents which describe the general actions and policy of the Navy with regard to technology transfer are contained in attachments 1 to 4 of the written copy of my testimony.

Prior Navy policy was completely consistent with the Technology Innovation Act and because of the existence of this policy, the Navy had an organization in place which could comply with the act. Each R. & D. activity of the Navy had a focal point oriented toward making technology transfer function efficiently and toward performing the functions outlined in 11(c)1 , 11(c)2, and 11(c)4 of the act.

Our inability to comply fully with the requirements of section 11(c)3 of the act relate to the ambiguous status of CUFT rather than from an unwillingness on the part of Navy laboratories to cooperate with, and assist, other organizations which link the research and development resources of the laboratories to potential users in the private industry and in State and local governments.

To the best of my knowledge, all Navy laboratories comply with that part of section 11(c) of the act which prohibits competition with similar services available in the private sector. However, as far as I know, no Navy laboratory has received—or, for that matter, has applied for funding from the Secretary of Commerce, as allowed in section 11(d)5, to provide reimbursement for the assistance specified in section 11(c)4. The Navy is in an excellent position to comply with the agency-reporting requirements of section 11(e) and attachment E to my testimony discusses this.

On March 5 of this year, NRL established an Office of Research and Technology Application. The mission of this group was compatible with section 11 of the act. The NRL ORTA has a professional staff backed up by adequate clerical and management support.

The subordinate responsibilities of the Federal laboratories with annual budgets greater than $20 million are of course covered in section 9 and 13 of the act. Section 9 of the act requires the Secretary of Commerce and the National Science Foundation to obtain advice and cooperation from agencies and Federal laboratories affected by the act. NRL, as an individual laboratory, and all of the other Navy laboratories, have excellent and effective working relations with NSF.

In the sense required by the act, our relations with the Secretary of Commerce are nonexistent. While NRL and the Navy laboratories have many useful and effective relationships with components of the Department of Commerce, such as NBS and NOAA, we have no contact with the office of industrial technology authorized by section 5 of this act or with the centers for industrial technology authorized by section 6 of this act.

Section 13 of this act directs the Secretary of Commerce and the NSF to establish a program to foster the exchange of scientific and technical personnel among academia, industry, and Federal laboratories. The act provides that such a program shall include exchanges supported with and without Federal funding. NRL and the Navy laboratories have long been involved in such exchanges and we believe this section of the act is functioning fully and successfully.

In all candor, however, I must admit that the success rate of such exchanges without Federal funding is very low, indeed. For the last 3 years, the Naval Research Laboratory has provided a technology agent for the community technology initiatives program under the authority of the Intergovernmental Personnel Act, which provides for the exchange of Federal personnel with those of local governments.

Our agent is based in Rockville, Md., and acts as a technical advisor to several cities located in Maryland, Pennsylvania, West Virginia, and Delaware. Other Navy laboratories have participated actively in this program.

In response to the law, the NRL order provides assessment of each research and development project to NRL. This is done annually when we provide NRL's input to the Navy's report on technology transfer.

We are involved in support of a manufacturing technology program under section 7.8 of the Navy budget. In this program, we work with our industrial counterparts to establish as an end-item deliverable an ability to use the technology at NRL and to establish an ability to manufacture products based on inventions which have their genesis at the laboratory.

As an example, NRL carried out an extensive program to develop the technology of laser welding. Under a manufacturing technology program, we are transferring this technology to the FMC Corp. in Minneapolis. The results will be a plant capable of performing computer-controlled laser welding at very high linear welding speed. We believe that this program will improve U.S. welding technology in a significant way.

Other examples can be given. Each year, the U.S. Navy makes hundreds of Government patents available for licensing. NRL laboratory personnel assist industrial licensees as necessary in converting these patents into industrial processes. I cite the National Technical Information Service circular of April 21, 1981, which lists Government inventions for licensing. One-fourth of all the cited patents were of navy origin and 40 percent of these were from NRL.

I think in a very real sense, this represents an outstanding example of technology transfer. While the DOD waiver, may have rendered some of the requirements of section 11 moot for the time being, I have some concerns with the interpretation of this section of the law. The major laboratories of the U.S. Navy do not have an annual budget. They are funded on an industrial basis. Every dollar administered by a Navy laboratory is provided on a cost-reimbursible basis in satisfaction of a performance contract between the laboratory and an R. & D. program manager.

If we accept funds and agree to perform certain services, these funds cannot be used for any other purpose whatsoever. Although overhead charges may be applied to the direct labor portion of the agreed upon task, the usage to which overhead funds may be applied is very tightly constrained.

In addition, other problems arise from the fact that in addition to R. & D. funding, the laboratories receive appropriations from OMN, SCN, et cetera. These funds are not part of the Navy's R. & D. appropriation. I do not believe that the law is clear as to whether these funds are to be included in computing the laboratories' annual budget. In the case of NRL, a further complication arises from the fact that we accept cost-reimbursible tasking from non-Navy agencies such as DOE, DARPA, NASA, et cetera. I'm not sure whether these would be included in the annual budget.

Overall, I would think it might be easier for laboratory and agency managers to follow the intent of Congress with regard to the act if Congress specifically appropriated the sum of money to be used to support the technology transfer function.

As a laboratory manager, I am somewhat uncomfortable with the possibility of ambiguous interpretations of section 11(B) and would appreciate it, if these issues were clarified.

As far as NRL and the Navy laboratories are concerned, the spirit of the law is being implemented thoroughly and effectively. Technology developed in Navy laboratories is being transferred to industry, to academia, and to State and local governments.

Although the process of transfer can be improved, I am persuaded that considerable progress has been made and that under the mandate of Public Law 96-480, such progress will continue to grow in the future.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Berman follows:]

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE COMMITTEE ON SCIENCE & TECHNOLOGY

STATEMENT OF

DR. ALAN BERMAN

DIRECTOR OF RESEARCH

NAVAL RESEARCH LABORATORY

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH & TECHNOLOGY

OF THE COMMITTEE ON SCIENCE & TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

ON

TECHNOLOGY TRANSFER IN THE NAVY

16 JULY 1981

Mr. Chairman and members of the Subcommittee:

1. Context of Testimony

I am testifying as the Director of Research of the Navy's corporate research laboratory, NRL. On a personal basis I am strongly committed to support the objectives of PL 96-480. I believe that I can demonstrate adequate and effective compliance on the part of the Naval Research Laboratory with the spirit ofthis act. I am familiar with Navy instructions applicable to Technology Transfer and in general terms I am familiar with the actions taken by other Navy Laboratories in response to these instructions. However, my Testimony should not be construed as representing the agreed upon position of either the US Navy or the DOD with regard to PL 96-480.

2. The US Navy's General Actions and Policy With Regard to Military Civilian Technology Transfer and Cooperative Development

The relevant documents which describe the general actions and policy of the US Navy with regard to Military Civilian Technology Transfer (T^2) and Cooperative Development are contained in

SECNAVINST 5700.14A dtd 12/14/79
NAVMATINST 5700.2A dtd 12/20/79
CNM ltr ser 2726 dtd 11/7/80

The specific response of the Naval Research Laboratory to section 11(b) of PL 96-480 is contained in

NRLNOTE 5400 dtd 3/5/81

Copies of these four documents are included as attachments 1-4 of the written copy of my testimony.

Basically, the Navy had a policy which encouraged Technology Transfer long before the passage of PL 96-480. This policy was formalized by the Secretary of the Navy in March 1972 in instruction (SECNAVINST 5700.14) which stated, "It is the policy of the Department of the Navy to promote military-civilian technology transfer and cooperative development on a systematic basis. It will encompass

(1) transfer of technology developed by the Department of the Navy for national defense purposes to the civilian sector where such technology can be profitably utilized in non-military applications and

(2) identification of coming technologies of both military and civilian interest and the exploration of feasibility for cooperative funding and/or development of such technologies."

This prior policy, along with its 1979 update, was completely consistent with the Technology Innovation Act. Because of the existance of this policy, the Navy had a functioning organization in place which was complying with the spirit of the act. Each research and development activity of the Navy has designated a focal point to coordinate and encourage technology transfer. The existing organizations, while not generally designated as an ORTA, as required by section 11(b) of the act, do in fact perform the functions outlined in sections 11(c)(1), 11(c)(2), and 11(c)(4) of the act.

Parenthetically the inability of the Navy laboratories to comply fully with the requirements of section 11(c)(3) of the act relate to the ambiguous status of CUFT rather than from an unwillingness on the part of Navy laboratories to cooperate with, and assist, other organizations which link the research and development resources of the laboratories to potential users in private industry and in state and local governments. To the best of my knowledge all Navy laboratories comply with that part of section 11(c) of the act which prohibits competition with similar services available in the private sector.

It is interesting to point out that to the best of my knowledge no Navy laboratory has received funding from the Secretary of Commerce as allowed in section 11(d)(5) to provide reimbursement for the assistance specified in section 11(c)(4).

The US Navy is in an excellent position to comply with the agency reporting requirement of section 11(e). Attachment (3) to this letter establishes a reporting requirement which has allowed the Navy to build a well founded data base regarding its activities in support of T^2. I believe that our record is impressive. As an example, I cite the National Technical Information Service circular of April 21, 1981 which lists government inventions for licensing. One quarter of all of the cited patents were of Navy origin. With pardonable pride I point out that 40% of these were from NRL.

At NRL, among our many other actions in support of Technology Transfer, we established by NRLNOTE 5400 dated March 5, 1981 an Office of Research and Technology Applications. This group has a mission statement which is compatible with section 11(c) of the act and has a two person professional staff backed by adequate clerical and management support. I am proud of the job they are doing.

3. Responsibilities of Federal Laboratories Under PL 96-480

The primary responsibilities of a Federal laboratory with an "Annual Budget" greater than $20 million under PL 96-480 are covered under section (11). Subordinate responsibilities exist under section (13) and section (9). I believe that with the possible exception of the requirement to make available to support Technology Transfer not less than .5% of the DOD R&D budget, the Navy laboratories are in essential compliance with section (11) of the act. The difficulty of complying with section (11)(c)(3) was mentioned above.

Section (9) of the act requires the Secretary of Commerce and the National Science Foundation to obtain advice and cooperation from agencies and Federal laboratories affected by the act. NRL as an individual laboratory, and I believe all of the other Navy laboratories have excellent and effective working relationships with NSF. Indeed Dr. Slaughter, the Director of NSF is an alumnus of the Navy Laboratory Community. Our relations with the Secretary of Commerce, in the sense required by this act, are nonexistent. While NRL and the Navy laboratories have many useful and effective relationships with components of the Department of Commerce such as NBS and NOAA, we have had no contact with the Office of Industrial Technology authorized by section (5) of this act or with the Centers for Industrial Technology authorized by section (6) of this act. If the requirements of section (5) and section (6) are implemented, NRL and the Navy laboratories will, as required by section (9) of the act, cooperate with both the Director of the Office of Industrial Technology and the Centers for Industrial Technology.

Section (13) of the act directs the Secretary of Commerce and the NSF to establish a program to foster the exchange of scientific and technical personnel among academia, industry and federal laboratories. The act provides that such a program shall include exchanges supported with and without Federal funding. NRL and the Navy laboratories have long been involved in such exchanges. Selected Navy laboratory personnel are assigned for one or two year periods to academic and industrial laboratories. Reciprocally numerous personnel from academia and industry spend extended periods at NRL and the Navy laboratories. From our vantage point this section of the act is being implemented fully and successfully, although in all candor, I must admit that the success rate of such exchanges without federal funding is very low indeed.

4. Discussion of NRL and Navy Laboratory Actions in Support of Technology Transfer. The Technology Transfer Focal Points and the NRL ORTA participate fully in the Federal Laboratory Consortium for Technology Transfer (FLC). I note that the secretariat of the FLC is located at the Naval Weapons Center in California and two of the regional coordinators are located in the Naval Underwater Systems Center, New London and the Naval Air Development Center in Warminster, PA. For the last three years, the Naval Research Laboratory has provided a technology agent for the Community Technology Initiatives Program under the authority of the Intergovernmental Personnel Act, which provides

for the exchange of federal personnel with those of local governments. This agent is located at Rockville, MD and acts as a technology advisor to several cities located in Maryland, Pennsylvania, West Virginia, and Delaware. Other Navy Laboratories have participated actively in this program. In accordance with PL 96-480, the Laboratory established its Office of Research and Technology Applications (ORTA) in March 1981. The Technology agent's activities and the laboratory focal point for Technology Transfer, staff this office insuring that the provisions of the law are met as far as the dissemination of information and cooperation with local governments is concerned. The law also requires that ORTA carry out an application assessment of each research and development project in which the Laboratory is engaged.

While this is done annually when providing the laboratory's input to the Navy report on Technology Transfer, the office is presently engaged in seeking ways to improve the assessment and to insure that all the research efforts are included. The appropriate mechanism by which this can be done is the Work Unit Assignment Summary or DD 1498.

In addition to these activities, NRL and the Navy laboratories are involved in supporting Manufacturing Technology Programs under subappropriation category 7.8. In these programs, Navy personnel work with their industrial counterparts to establish in industry an ability to use technology developed in Navy laboratories and to establish an ability to manufacture products based on inventions which had their genesis at Navy laboratories. As an example, NRL carried out an extensive program to develop the technology of Laser Welding. Under a Manufacturing Technology program, we are transferring this technology to the FMC corporation in Minneapolis. The result will be a plant capable of performing computer controlled laser welding at high linear welding speeds. We are proud of this activity and believe that it will improve US welding technology in a significant way.

The DOD and the Navy operate Information Analysis Centers. These provide specialized technical information to industry in many fields ranging from nondestructive testing to Metal Matrix Composite materials. By making this information available to industry and academia, the DOD is in fact engaged in an effective transfer of technology from DOD laboratories to industry.

One final activity should be noted. Every year, the US Navy makes hundreds of Government patents available for licensing. Navy laboratory personnel assist industrial licensee's as necessary in converting these patents into industrial processes and products. In a very real sense, this also represents an outstanding technology transfer activity.

5. Personal Concerns Regarding PL 96-480. However strongly I may be committed on a personal basis to the spirit and objectives of PL 96-480, it is perhaps appropriate for me to enunciate some concerns I have with the law as drafted. Section 11(b) requires that each Federal laboratory having a total "annual budget" exceeding $20 million shall provide at least one professional staff member for its ORTA and that each Federal agency which operates or directs one or more federal laboratories shall make available not less than .5 percent of the agency's research and development budget to support the technology transfer function. Although the DOD waiver of these requirements

may have rendered them moot for the time being, in my view there is a problem with this section of the law.

The laboratories of the US NAVY do not have an "annual budget." We are funded on an industrial basis. That means that every dollar that is administered by a Navy laboratory is provided on a cost reimbursable basis in satisfaction of a performance contract between the laboratory and the manager of a R&D program. In other words, if NRL accepts funds from a manager of an R&D program and for example, agrees to perform certain services for the Aegis radar program, these funds cannot be used for any other purposes whatsoever. While overhead charges may be applied to the direct labor charge portion of the agreed upon tasking, the usage to which overhead funds may be applied is tightly constrained. Much of the funding which comes into Navy laboratories comes from appropriations such as OMN, SCN, etc. rather than from part 6 (R&D) of the Navy's appropriation. I do not believe that the law is clear as to whether these funds are to be included in computing the Laboratory's "annual budget" against which the .5 percent assessment is to be made. In the case of NRL, a further complication arises from the fact that we accept cost reimbursable tasking amounting to about 30 million dollars from non-Navy agencies such as NASA, DOE, DARPA, etc. It is not clear that these funds are to be included in the "annual budget" assessed in satisfaction of the requirements of Section 11(b) of PL 96-480. Depending on interpretation of the words "annual budget," a laboratory such as NRL might allocate anything from zero to 1.5 million dollars to support the technology transfer function.

In the Navy laboratories, each subsection of each laboratory is organized on a cost center basis. The requirement to allocate a fixed amount to a given segment of a laboratory's activity independent of the true cost of operation appears to be incompatible with sound laboratory management. From the standpoint of agency and laboratory managers, this section of the law appears to direct a conversion of money from an approved appropriation to purposes other than those explicitly directed by Congress. It might be easier for laboratories and agency managers to follow the intent of Congress with regard to PL 96-480, if Congress specifically appropriated a sum of money to be used to support technology transfer functions. As a laboratory manager, I am uncomfortable with the apparent ambiguities of Section 11(b) and would appreciate clarification of the issues I have alluded to.

6. Summary Concepts. In summary, although I have certain specific concerns with the requirements of Section 11 of the act, and although the DOD has elected to waive the requirement to invest .5 percent of its R&D budget in Technology Transfer I am of the belief that insofar as NRL and the Navy laboratories are concerned the spirit of the law is being implemented enthusiastically and effectively. Technology developed in Navy laboratories is being transferred to industry, to academia, and to state and local governments. Although the process of transfer can be improved, I am persuaded that considerable progress has been made and that under the mandate of PL 96-480 such progress will continue to grow in the future.

Mr. Chairman, I am prepared to answer any questions the Committee may have.

320

DEPARTMENT OF THE NAVY
HEADQUARTERS NAVAL MATERIAL COMMAND
WASHINGTON, D.C. 20360

IN REPLY REFER TO

078/TW
Ser 2726
0 7 NOV 1980

From: Chief of Naval Material

Subj: Military-Civilian Technology Transfer and Cooperative Development Program

Ref: (a) SECNAVINST 5700.14A
(b) OPNAVINST 5700.13
(c) NAVMATINST 5700.2A

Encl: (1) Technology Transfer Report Formats

1. References (a), (b) and (c) are the governing directives for the Navy's Military-Civilian Technology Transfer and Cooperative Development program. References (a) and (b), which are contained in reference (c), require an annual submission to the Secretary of the Navy on the progress of the program and its accomplishments.

2. Addressees are requested to provide inputs for the next annual report to reflect the Technology Transfer and Cooperative Development work conducted in FY 1980; i.e., work initiated, continued through, or completed between 1 October 1979 and 30 September 1980. The information provided will be released to the public and should have prior approval for release before submission by each activity. Specifically, addressees are requested to:

a. Provide a summary or the highlights of the most significant technology transfer projects for the annual report to the Secretary of the Navy, utilizing format (a) of enclosure (1).

b. Describe all FY 1980 technology transfer projects in detail, using format (b) of enclosure (1). Include transfers of technology into the Navy which consist of significant non-Navy projects or ideas of interest to Navy R&D that were brought to Navy attention by the FY 1980 Navy Technology Transfer Program. Identify these items by the word "INTO" after the identification number in line 2 of format (b).

c. List Navy inventions and patents applied for or issued during FY 1980 that have a high commercial potential. To prevent premature patent disclosure or infringement of patent rights, it is requested that this listing be reviewed by the activity patent counsel. Information should include patent or case number, description, purpose, potential commercial application, and performing activity. Use format (c) of enclosure (1).

[illegible]

NOV 12 1980

[illegible]

d. List all significant participation in technology transfer functions such as meetings, committees, seminars, conferences, workshops, symposia, exhibits, publications, speeches, etc. Also provide narrative descriptions of activities involving GIDEP, invention licensing, the Federal Laboratory Consortium, personnel assignment programs, or any other special technology transfer function. Use format (d) of enclosure (1).

e. Provide the names, telephone numbers (commercial and Autovon), and addresses of activity technology transfer officials or focal points.

3. The information requested in paragraph 2.a. above will be utilized for the report to be forwarded to the Secretary of the Navy. The information requested in paragraphs 2.b. through 2.e. will be published separately as Summary Statistics for the fiscal year and will be distributed to all addressees.

4. Addressees are requested to submit all inputs to Headquarters Naval Material Command by 1 January 1981. Negative replies are required. Questions or problems should be directed to Mr. T. Wolfe, 202-692-0515, Autovon 222-0515.

P. B. NEWTON, JR.
By direction

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Subj: Military-Civilian Technology Transfer and Cooperative Development Program

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Technology Transfer Focal Points

DEPARTMENT OF THE NAVY
HEADQUARTERS NAVAL MATERIAL COMMAND
WASHINGTON, D. C. 20360

IN REPLY REFER TO
NAVMATINST 5700.2A
MAT 08T4:SCA

20 DEC 1979

NAVMAT INSTRUCTION 5700.2A

From: Chief of Naval Material

Subj: Military-Civilian Technology Transfer and Cooperative Development

Ref: (a) SECNAVINST 5700.14
(b) SECNAVINST 5870.2C

Encl: (1) OPNAVINST 5700.13

1. Purpose. To provide for systematic transfer of appropriate technology developed by the Department of the Navy for national defense purposes to the civilian sector and for the identification and cooperative development of coming technologies of both military and civilian interest as required by enclosure (1).

2. Cancellation. NAVMATINST 5700.2.

3. Discussion

a. The Department of the Navy has developed certain technologies for military purposes which were transferred to, and proved to be valuable for, the civilian economy. The Department of the Navy and various civilian agencies have also cooperated in the development of various technologies; this cooperation has reduced costs and was mutually beneficial. Most of these activities were conducted on an *ad hoc* rather than a systematic basis.

b. In this period of growing demands on limited national resources, it is important to pursue systematically all avenues that will bring about more effective utilization of available assets. By reference (a), forwarded by enclosure (1), the Secretary of the Navy stated that, subject to the general guidance of the Assistant Secretary of the Navy (Research, Engineering and Systems), it is the policy of the Department of the Navy to promote military-civilian technology transfer and cooperative development, and assigned responsibility for arranging implementation of this policy to the Chief of Naval Operations. Reference (b) provided for increased commercialization of Navy technology by delineating policy and procedures for the licensing of rights in domestic patents and patent applications vested in the United States of America and in the custody of the Department of the Navy.

4. Responsibilities. In accordance with enclosure (1), the Chief of Naval Material (CNM) has been designated to act for the Chief of Naval Operations in implementing the Navy's military-civilian technology transfer and cooperative development policy. The Assistant Deputy Chief of Naval Material (Technology) is hereby designated the Director of Military-Civilian Technology Transfer and Cooperative Development responsible to the CNM for the execution of this program.

5. Action. The addressees will designate a point of contact for military-civilian technology transfer and cooperative development. They will advise Headquarters, Naval Material Command (MAT 08T4) of the name of the point of contact within 60 days. Additional guidance shall be issued by the Director of Technology Transfer.

James R. Lewis

James R. Lewis
Assistant Deputy Chief of Naval Material
(Technology)

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DEPARTMENT OF THE NAVY
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20350

SECNAVINST 5700.14A
50-3
14 December 1979

SECNAV INSTRUCTION 5700.14A

From: Secretary of the Navy

Subj: Military-Civilian Technology Transfer and Cooperative Development

Ref: (a) SECNAVINST 5870.2C (A

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1. Purpose. To establish a systematic and comprehensive policy for the transfer of appropriate technology developed by the Department of the Navy for national defense purposes to the civilian sector and for the identification and cooperative development of coming technologies of both military and civilian interest.

2. Cancellation. SECNAVINST 5700.14.

3. Background

a. In recent years, the Nation has been experiencing severe shortages of resources to satisfy its total needs. The spectrum of modern technology in particular has become so broad that available resources are no longer sufficient to develop and utilize technology's entire potential. In order to maximize the Nation's realization of the benefits of technology, it becomes essential that available resources are used as effectively as possible.

b. For many years, the civilian sector has derived significant benefits from the Department of the Navy efforts in the development and application of technology. In the post-World War II period, the U.S. Navy was the principal factor in the growth of oceanography in the United States, thus stimulating the move of industry into the oceans to exploit their resources. In 1967, the Department of the Navy declassified and made available for civilian use the Navy Navigation Satellite System, which is of great value to ships requiring accurate navigation such as those employed by off-shore oil exploration companies and the industrial oceanographic community. Since 1962, the Department of the Navy has been cooperating with the Department of Commerce in Project Stormfury, a program developing techniques for reducing destructive wind velocities of hurricanes. In this instance, the Department of the Navy has been both a contributor and a beneficiary inasmuch as the Navy's resources have been saved and/or extended through this Navy-Commerce cooperation. A number of naval laboratories currently have small but active programs of technology transfer to civilian agencies.

c. In October 1976, the Department of the Navy implemented reference (a) which established a program to facilitate commercialization of new Navy technology through the granting of nonexclusive and limited exclusive (A licenses for Navy inventions. This inventions licensing program, augmented by Navy technology transfer endeavors, provides attractive opportunities for business ventures which require the protection afforded by patents to open new markets, and/or expand existing markets.

d. In all of these cases - and many others not cited here - the action was undertaken on an ad hoc and compartmentalized basis. Both the Department of the Navy and the Nation can derive considerably greater benefits if this activity is systematically encouraged as a matter of policy.

4. Policy

a. It is the policy of the Department of the Navy to promote military-
civilian technology transfer and cooperative development on a systematic
basis. It will encompass (1) transfer of technology developed by the
R) Department of the Navy for national defense purposes to the domestic and
R) foreign civilian sectors where such technology can be profitably utilized
in non-military applications, and (2) identification of coming technologies
of both military and civilian interest and the exploration of feasibility
for cooperative funding and/or development of such technologies.

b. This policy is undertaken in the interest of the most economical development and utilization of technology in the Department of the Navy and the Nation at large. In its execution, appropriate care will be taken to avoid actions which might create the appearance of undue influence over private enterprise and the free operation of the economy.

c. This policy is subject, as may be appropriate, to regulations of other Government agencies governing the export of technical information relating to arms, ammunition or munitions of war, as well as to other articles. See, for example, International Traffic in Arms Regulations, 22 C.F.R. Parts 121-128, under the cognizance of the Office of Munitions Control, Department of State; and the Export Control Regulations, 15 C.F.R. Parts 368-399, under the cognizance of the Office of Export Control, Department of Commerce. In addition, this policy is subject to applicable regulations concerning security of classified material.

5. Action

R) a. The Assistant Secretary of the Navy (Research, Engineering and
Systems) will provide general guidance in military-civilian technology
transfer and cooperative development and will submit an annual report
to the Secretary of the Navy on accomplishments in this area.

b. The Chief of Naval Operations will arrange implementation of
this instruction and will submit an annual report to the Assistant
R) Secretary of the Navy (Research, Engineering and Systems) on program
progress.

c. All components of the Department of the Navy shall cooperate in the execution of the subject policy.

6. Reports. The requirements set forth in paragraphs 5a and 5b are assigned symbols SECNAV 5700-1 and SECNAV 5700-1A, respectively. These reports are approved for two years only from the date of this directive.

E. Hidalgo

Edward Hidalgo
Secretary of the Navy

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NRLNOTE 5400
5 March 1981

NRL NOTICE 5400

From: Commanding Officer
To: Distribution Lists A and B

Subj: Office of Research and Technology Applications (Code 1432); establishment of

Ref: (a) Public Law 96-480, Section 11 dated 21 October 1980
(b) Memo 1000-126:EEH:mli dated 13 August 1980

1. Information. It is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal investment in research and development. To this end, the Federal Government shall strive where appropriate to transfer Federally owned or originated technology to State and local governments and to the private sector. To accomplish this, each Federal laboratory has been directed to establish an Office of Research and Technology Applications in accordance with reference (a).

2. Organizational Change. Effective the date of this notice, the Office of Research and Technology Applications (Code 1432), Management Information Systems and Special Projects Branch, Management Information Division is established as directed by and in accordance with reference (a).

3. Personnel Assignments

a. Mr. Richard Fulper, Jr. (Code 1434) is assigned additional duty as Head, Office of Research and Technology Applications (Code 1432).

b. Mr. Matthew Shaw, Jr. is reassigned from Code 7001 to Code 1432.

4. Mission Statement. The Office of Research and Technology Applications is responsible for: (1) preparing an application assessment of each research and development project in which the Laboratory is engaged which has potential for successful application in State or local government or in private industry; (2) providing and disseminating information on Federally owned or originated products, processes, and services having potential application to State or local governments and to private industry; (3) cooperating with and assisting the Center for the Utilization of Federal Technology and other organizations which link the research and development resources of the Laboratory and the Federal Government as a whole to potential users in State or local government and private industry; and (4) providing technical assistance in response to requests from State and local government officials.

5. Action

a. Personnel Assignments. Personnel actions resulting from these changes should be initiated by the Management Information Division as soon as possible but no later than 30 days from the date of this notice. Position descriptions shall be reviewed and updated as necessary based on this reorganization.

b. Ceiling Point Transfers. The office of the Associate Director of Research for Space and Communications Technology (Code 7000) shall submit a memo in accordance with reference (b) to effect ceiling point transfers.

c. Security Requirements. The Management Information Division shall submit a Form NDW-NRL 5511/1253 for each local control point to be established in accordance with NRLINST 5510.40A.

d. Space and Equipment. Reassignment of space and equipment will be made as circumstances require. The Management Information Division will provide the Facilities and Equipment Control Branch (Code 1420) with a list of from-and-to code numbers resulting from this change and the room numbers assigned to each code. Change information shall be submitted on Form NDW-GEN 2305/2 to Codes 1226.3, 2020, and 2551 to update the employee locator information and to facilitate mail handling.

E. E. HENIFIN

Mr. ERTEL. Thank you very much for your very precise and illuminating testimony.

Capt. David Parrish, Deputy Director for Laboratory Management, Naval Material Command.

Captain PARRISH. I appreciate the opportunity to appear before your subcommittee today. I will briefly summarize the submitted testimony.

I think it is important that the subcommittee know that the Navy still provides support to the FLC, the Federal Laboratory Consortium, with a Navy employee currently assigned to the National Science Foundation to coordinate consortium activities.

Another Navy employee at the Naval Weapons Center has served as the chairman or president since the consortium's inception. I included in my prepared testimony an enclosure which summarized the report to the secretary, of the technology transfer efforts for the years 1978 and 1979. In my prepared statement, I listed that the Navy undertook 224 projects for sponsors from Federal agencies, State and local governments, industries, small businesses and nonprofit institutions.

The 1980 report of technology transfer efforts within the Navy is in draft at this time. I would be pleased to submit a copy to the subcommittee if you would like to have it.

Mr. ERTEL. We would like to have it and it will be admitted into the record when it is finalized, without objection.

Captain PARRISH. I will speak to the eight Chief of Naval Material Laboratories. At each of the laboratories, we have a person in place charged with technology transfer. He does not at this time have the title of ORTA and he may not in all cases.

But each of these people is a member of the Federal Laboratory Consortium. We at the Chief of Naval Material Headquarters are charging the commander and the technical directors of each laboratory to consider the technology transfer possibility during all project or program reviews.

The ORTA assessment function will occur in this process. The technology transfer person will participate in this review. He will then be charged to promote the transfer through the FLC and the various DOD and Navy administrative machinery.

Initially there is a form at each laboratory which describes every project. These are available to the technology transfer person for review to identify technology which might be suitable for transfer outside of the annual review. To insure that the transfer actually occurs, we include in the commanding officer and technical director annual R. & D. center review before the Chief of Naval Material a requirement to present the accomplishments of that center under the Stevenson-Wydler Act.

That is an annual event. We feel that that is the management tool under which we can assure an aggressive response to the will of the Congress as regards Stevenson-Wydler.

Finally I would offer that I read Senator Mathias' prepared statement from yesterday's testimony, and in particular in regard to the Baltimore conference that he held and you mentioned earlier.

You may find it of interest to know that the Naval Air Development Center at Warminster, Pa., did a great deal of work in preparing and assisting the Senator in the discharge of that conference.

Thank you.

[The prepared statement of Captain Parrish follows:]

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

STATEMENT OF

CAPTAIN DAVID F. PARRISH, U.S. NAVY

ASSISTANT DEPUTY CHIEF OF NAVAL MATERIAL

FOR LABORATORY MANAGEMENT

HEADQUARTERS NAVAL MATERIAL COMMAND

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

HOUSE SCIENCE AND TECHNOLOGY COMMITTEE

ON

STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980 (P.L. 96-480)

DON MILITARY-CIVILIAN TECHNOLOGY TRANSFER AND COOPERATIVE DEVELOPMENT PROGRAM

The Navy instituted a formal Technology Transfer and Cooperative Development Program in 1972 as a result of successful experimental technology transfer programs organized in the late 1960s and early 1970s.

The advantages of technology transfer include cost-effective use of tax dollars, solution of national problems, contributions to the primary Navy mission, and opportunities for good public relations.

The Navy took the lead in technology transfer by organizing an informal consortium of laboratories in 1970 which developed into the Federal Laboratory Consortium on Technology Transfer. The Consortium provides an effective person-to-person communication network for technology transfer. The Navy still provides support to the Consortium, with a Navy employee currently assigned to the National Science Foundation to coordinate Consortium activities, and another Navy employee at the Naval Weapons Center serving as either chairman or president since the Consortium`s inception.

The Navy Program is chartered "to establish a systematic and comprehensive policy for the transfer of appropriate technology...to the civilian sector and for the identification and cooperative development of coming technologies of both military and civilian interest." The Program has been oriented toward support of Federal Agencies, but efforts are are now underway to also emphasize programs for local governments, small business and industry in cooperation with such organizations as the Department of Commerce and the National Science Foundation. Additionally, many of the projects for other Federal Agencies have had benefits for local governments and the private sector. The Program provides unique services not available from the public sector and not in competition with the private sector.

The Chief of Naval Material (CNM) is assigned Navy-wide responsibility for the Technology Transfer Program by OPNAVINST 5700.13, which implements SECNAVINST 5700.14A. NAVMATINST 5700.2A designates the Assistant Deputy Chief of Naval Material (Technology) as the Director of Military-Civilian Technology Transfer and Cooperative Development for the Navy. The Navy Technology Transfer Program has been formally documented since 1972, with the SECNAV Instruction updated at the end of 1979.

CNM responsibilities include coordinating the systematic transfer of technology developed by the DON for defense purposes to the civilian sector, identifying coming technologies of both military and civilian interest, and submitting the annual Navy technology transfer report to SECNAV. The report to SECNAV for Fiscal Years 1978 and 1979 is provided for the record.

The Navy technology transfer program includes a network of technology transfer agents at over 60 Navy activities. The agents interact with Federal agencies, local and state governments, and commercial firms to identify and define problems and apply technological solutions.

The Navy Technology Transfer Fact Sheet, distributed to over 3800 businesses and organizations, describes Navy inventions available for licensing and technological innovations with potential civilian applications.

Substantial benefits were realized through the Technology Transfer and Cooperative Development Program during 1980. The Navy undertook 224 projects for sponsors from federal agencies, state and local governments, industry and small businesses, and nonprofit institutions. Navy technology found its way into commercial markets, for example, by transferring such technologies as aircraft nonmetallic spline coupling adapters and conducting polymers to industry. These productive results illustrate the continuing effectiveness of the Navy Technology Transfer and Cooperative Development Program.

REPORT ON THE TECHNOLOGY TRANSFER
AND
COOPERATIVE DEVELOPMENT PROGRAM
DEPARTMENT OF THE NAVY
FISCAL YEARS 1978 AND 1979

FOREWORD

The Navy instituted a formal Technology Transfer Program in 1972. The Program is chartered "to establish a systematic and comprehensive policy for the transfer of appropriate technology . . . to the civilian sector and for the identification and cooperative development of coming technologies of both military and civilian interest."

In Fiscal Years 1978 and 1979 approximately $35 million was invested in unique Navy technology and expertise by project sponsors representing the Federal Government, state and local governments, businesses, and non-profit organizations. These projects fostered technology transfer and helped prevent duplication of technological efforts. The Navy provided assistance to state and local governments and businesses. Where appropriate, some assistance was arranged through cooperative projects with other federal agencies.

During these two years, the Technology Transfer Program continued to produce benefits, enhancing the improvement of existing products and processes. Navy technology transferred to the civilian sector addressed fundamental and important areas of medical care, pollution abatement, transportation, and safety. Results were constructive and illustrate the continuing success of the Navy Technology Transfer Program.

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SECTION 1

INTRODUCTION

I. OBJECTIVES

The objectives of Navy technology transfer are (1) transferring technology from military uses to public and private applications; and (2) promoting joint cooperative development programs that address problems of mutual concern to the Navy and other agencies or organizations.

II. SCOPE

In pursuit of the objectives, the Navy transfers technical expertise to other federal agencies; state and local governments; small and large businesses; nonprofit organizations; and such public service organizations as schools, hospitals, and foundations. In addition, technologies that have direct impact on the Navy mission and programs are transferred within, or into, the Navy. Transfers of hardware, software, management practices, and expertise are made in diverse fields, such as analysis and testing, communications, energy, environment, transportation, and marine technology. The Navy Technology Transfer Program provides unique services not available from the private sector and not in competition with that sector.

III. ADVANTAGES

Advantages of technology transfer include cost-effective use of tax dollars, solution of national problems, contributions to the primary Navy mission, and opportunities for good public relations.

IV. DEFINITION

The term technology transfer as used in this report refers to a purposeful, continuous effort to move technical expertise, products, and information to new uses or users.

SECTION 2

HIGHLIGHTS FOR FISCAL YEARS 1978 AND 1979

I. FEDERAL AGENCIES

A major focus of Navy technology transfer is on supporting federal agencies with primary mission responsibilities for domestic programs. This policy is consistent with OMB Circular No. A-109, which encourages agencies to cooperate in transferring technology and preventing unwarranted duplication of effort. The following examples were selected from over 300 projects funded at approximately $30 million by federal agencies during FY 1978 and 1979:

A. Energy

With the support of the Department of Energy, the Naval Ordnance Station at Indian Head, Maryland, developed a process to replace fuel oil with "clean" coal which offers a decrease in pollution as well as a decrease in the consumption of imported oil.

B. Environment

The David W. Taylor Naval Ship Research and Development Center provided test data and advice to the Environmental Protection Agency, which had responsibility for selecting high-temperature materials for a mobile detoxification kiln. The kiln is part of a mobile environmental restoration complex capable of incinerating and decomposing chemicals such as kepone and malathion.

C. Fire and Safety

For the past seven years the Coast Guard and the Department of Energy have funded the Naval Weapons Center to study hazards of large accidental spills of cryogenic materials, such as liquid natural gas, liquid propane gas, and liquid ammonia, materials often transported by ship to large metropolitan areas. A liquid natural gas spill facility was built in FY 1978, and over 29 pool and vapor ignition tests were completed. In FY 1979 the design of a facility capable of spill-testing 40 cubic meters of liquid natural gas or other similar hazardous material was completed, and the contractor bidding phase is under way.

D. Instrumentation

Bringing to bear technical expertise in avionic systems/sensors, the Naval Air Development Center, Warminster, Pennsylvania is assisting in the development of an airborne, remote instrumentation system (AIREYE) for the Coast Guard's medium-range surveillance aircraft. The aircraft will be used for missions involving search and rescue, law enforcement, and environmental protection.

E. Transportation

1. To facilitate access to SWATH technology, as requested by industry, the Naval Sea Systems Command provided design guidelines and guidance to the Maritime Administration, which developed a conceptual design and cost estimate for a SWATH towed-array ship and surveillance platform.
2. A self-powered vehicle detector which has potential application in automobile traffic control was developed by the Naval Surface Weapons Center. The system transmits information to a nearby receiver control unit and can be used for counting, detecting, and measuring vehicle speed.

F. Computer Technology

The Naval Ocean Systems Center is developing image scanning and enhancement techniques for use in automated mail-handling systems for the U.S. Postal Service. The image-capture and analysis system is operating; full-page images at 10 pages per second have been acquired.

II. STATE AND LOCAL GOVERNMENTS

During FY 1978 and 1979 the Navy provided technical assistance for 46 state and local government projects through funded projects totaling almost $700,000. Positive results are indicated by the following:

A. Health and Medicine

1. For the past twenty years the Naval Submarine Medical Research Laboratory has cooperated with local school health officials to test and evaluate visual color deficiencies in 500 high school students. The Laboratory provides equipment for testing, educates school nurses, tests and evaluates students who fail the initial school examination, and provides a personal career counseling service.

2. Due to the recent increase in disability retirements attributable to stress-related disease (particularly among policemen and firemen), the San Diego Technology Action Center arranged for the Naval Health Research Center to advise San Diego County and city officials on the revision of medical screening and examination procedures used to detect cardiovascular disease. A joint project to study the epidemiology of stress-related retirements also was undertaken by the Naval Health Research Center and sponsored by the Local Government Assistance Task Force of the Federal Laboratory Consortium's Far-West Region.

B. Transportation

Over several years, the David W. Taylor Naval Ship Research and Development Center participated in the development of an air cushion vehicle suitable for arctic operations. When the resulting findings and developments were made available to Alaskan officials, the Center was consulted on the suitability of air cushion vehicles for transporting school children and on a demonstration program designed by the Alaska Department of Transportation to generate technical, environmental, and economic data on air cushion vehicle options for transporting cargo and passengers. An expected result is that the development of an air cushion vehicle industry in Alaska will be facilitated.

III. INDUSTRY AND SMALL BUSINESS

In FY 1978 and 1979 the Navy performed more than 170 projects funded at over $3 million by industry and small business. Typical projects included:

A. Analysis and Testing

1. The Civil Engineering Laboratory operates the Advanced Energy Utilization Test Bed which features (1) the capacity to test energy systems individually or concurrently and to switch among the systems rapidly; and (2) the ability to evaluate wind and solar power sources and several energy conservation systems, including lighting, heating/cooling, electricity, and detectors to measure energy losses. In FY 1978 a glass fiber wall covering was tested that reduced air leakage a nominal 55 percent. The company which developed the covering is conducting a two-year controlled experiment to monitor energy savings and evaluate commerical potential.

2. The Naval Air Engineering Center has investigated the frictional wear particles produced from machine operation. By analyzing lubricating oil, distinctive wear particles can be identified which correlate to the equipment's condition. Without disassembling the equipment, wear particle analysis can determine the need for maintenance or preventive maintenance and can serve as a tool for designing equipment. The Center produced the Wear Particle Atlas, an instructional and reference document which details the use of oil wear particle analysis for diagnosing machine operating conditions. Over two dozen companies use all or several of the Center's oil wear particle analysis techniques, and the number of interested companies continues to grow.

B. Computer Technology

The Office of Naval Research has sponsored the development of innovative computer applications which have been transferred to industry. For example, the Office of Naval Research developed under contract with the University of Arizona a unique modular computer program, GIFTS, which is simple, efficient, interactive, graphics-oriented, and suitable for use in structural analysis and design, such as in shipbuilding or architecture. Over 100 industrial and academic organizations have requested information on GIFTS, and a dozen companies are supporting GIFTS research by subscribing to a University of Arizona service which answers specific questions about applying GIFTS and updates ongoing research.

C. General Assistance

The Navy Technology Transfer Fact Sheet Reader Reply Service provides information on Navy inventions, manufacturing and scientific processes, and marketable technologies. The Fact Sheet contains a reader reply form, which enables the reader to request further information by checking and mailing the form. During FY 1978 and 1979 the Fact Sheet responded to over 7,800 requests from industry for technical information.

IV. NONPROFIT ORGANIZATIONS

Nonprofit organizations sponsored 36 projects funded at slightly less than $1 million dollars. Examples include:

A. Health and Medicine

The Naval Health Research Center developed a Recent Life Changes Questionnaire which measures the relationship between health and stress associated with significant life changes, such as job loss and illness or death in the family. About 40 questionnaires are distributed monthly and the Center annually receives 20 to 30 requests for advice on its use. American and international researchers employ the questionnaire to analyze small groups and to conduct extensive epidemiological surveys. An Australian study of over 800 adults suggested further research applications by using a modified questionnaire to demonstrate significant relationships between stress and mental health.

B. Marine Technology

The Naval Ocean Systems Center assisted the Institute for Acoustic Research, Miami, Florida in installing a large underwater acoustic projector and cabling.

C. General Assistance

The Naval Underwater Systems Center detailed a civil engineer to the Community Technology Initiatives Program, which is supported by the National Science Foundation and designed to assemble, organize, and deliver applied science and technology to local governments. The engineer is working with the city manager of East Providence, Rhode Island, and with five northeastern communities of under 50,000 people to define and resolve technological problems confronting the towns in areas such as firefighting equipments, solid waste management, public works programs, and energy-efficient housing.

V. NAVY COMPONENTS

Valuable fallouts from Navy-funded projects accrue to raise the standard of living. For example:

A. Analysis and Testing

A device and technique designed to test (in-situ) high strength alloy steels for embrittlement due to hydrogen infiltration was developed at the Naval Air Development Center. Special interest has been shown by automobile, heavy equipment, chemical, and oil companies.

B. Environment

A new type of corrosion-preventive compound, developed and evaluated by the Naval Air Development Center drives out any existing moisture and air-dries to form a clear, continuous, dry, and relatively hard coating when applied. The compound is of interest to groups representing airlines as well as owners of automobiles and boats. The product is being manufactured for the private sector by two firms under the trade names AMALGARD and Product 1900, and licenses for two related products have been granted.

C. Health and Medicine

1. Research on diver recompression procedures, jointly funded by the Naval Medical Research and Development Command and the Naval Sea Systems Command, culminated in the publication, Recompression Treatment Tables Used Throughout the World by Government and Industry. This report is the only available compilation of such information.

2. A portable field kit for rapid diagnosis of diseases, such as meningitis, streptococcal infections, and pneumonia, was developed at the Naval Health Research Center. The kit, contained in a shock-resistant, six-inch deep briefcase, can be used in field public health and small dispensary applications. At the request of and in cooperation with the World Health Organization, the field kit has been tested in Africa and the Middle East in the specific diagnosis of cerebrospinal meningitis.

D. Transportation

The Naval Sea Systems Command manages a comprehensive program to ensure that the gas turbines used to power two new classes of Navy ships are protected against corrosion resulting from the reaction of hot metal with sea salt and fuel sulfur. Several engine companies have participated in the Navy's efforts and have applied this technology to industrial gas turbines, which are sold as power sources for electricity generators and gas line compressors. The improved engines directly benefit the U.S. economy by allowing U.S. engine builders to compete effectively in the large, but highly competitive, export market.

SECTION 3

MAJOR COMPONENTS OF THE NAVY TECHNOLOGY TRANSFER PROGRAM

I. GOVERNMENT-INDUSTRY DATA EXCHANGE PROGRAM

The Navy manages this cooperative program, which is sponsored by the Department of Defense, other federal agencies, and the Canadian Department of Defense. The Government-Industry Data Exchange Program enables government and industry to supply information for and retrieve information from four specialized data banks covering systems and equipment reliability-maintainability, engineering, and failure experience. The Program offers two unique services, (1) the ALERT system notifies participants of problem areas, and (2) the Urgent Data Request System permits members to query all participants on specific problems. Participants saved $50 million (cost avoidance) in the two-year period from January 1977 through December 1978.

II. INVENTION LICENSING PROGRAM

The Office of Naval Research, in cooperation with the Headquarters Naval Material Command, manages this program as follows:

A. Patented Navy inventions are licensed to private industry and small businesses for commercial development. In FY 1978 the Navy granted 11 licenses including a license on a portable constant current power pack which promotes bone healing. The 12 licenses granted by the Navy in FY 1979 included licenses for an electromagnetic flowmeter, an optical slip ring arrangement, and a low-flow gas or liquid calibrator.

B. A modest experimental program begun in FY 1977 permitting selective filing of patent applications for inventions with high commercial potential in foreign countries was continued. In FY 1978 the Office of Naval Research filed patent applications in nine foreign countries on a crystal semiconductor device which can be used as an infrared detector or a photovoltaic cell. It can be manufactured in batches for about $20.00 each and is considered more sensitive, accurate, and long-lived than available comparable devices which cost $15,000 to $20,000. The program is ongoing.

III. FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

The Federal Laboratory Consortium for Technology Transfer seeks to maximize the impact of laboratories' unique technial expertise and products when applied to problems facing government and industry. Participants include 18 Navy activities, with the addition of the Naval Ocean Research and Development activity in 1979. Navy support for the Consortium included:

A. A staff member at the Naval Weapons Center has served as Consortium Chairman since its inception.

B. Under a National Science Foundation grant, the Naval Weapons Center organizes semiannual meetings, publishes a monthly News Items, and compiles the annual Resource Directory.

C. In FY 1978, the Consortium designated the Navy Personnel Reseach and Development Center as focal point to establish and chair the Consortium's Far West Region Local Government Assistance Task Force. Initially the Task Force, designed to facilitate contacts between local officials and federal laboratories, worked with San Diego officials to identify target needs and to plan projects. In FY 1979, information was sent to various city departments on the following materials and programs: (a) aerial photography in environmental data gathering, (b) a dust suppression polymer, (c) an evaporation suppression polymer, and (d) a computerized personnel system.

IV. INTERGOVERNMENTAL ASSIGNMENT OF PERSONNEL

The Intergovernmental Personnel Act permits short-term assignment of personnel to other branches of federal and local government. Assignments broaden the experience of Navy personnel and facilitate the application of unique expertise to government programs. Participation has included the following assignments:

A. The Naval Underwater Systems Center participated in the intergovernmental transfer of personnel, for example:

1. A computer systems analyst assigned to the New York City Police Department designed an automated fuel dispensing and monitoring system and was scheduled to oversee the installation of pilot systems in three Staten Island precincts and ultimately throughout the department. The system is designed to reduce labor costs and should save $1.5 million a year when implemented throughout the department.

2. A biological oceanographer was assigned to the University of Connecticut Marine Research Institute to work with Institute personnel on a broad spectrum of research areas dealing with coastal waters biology. A major focus of the assignment will be the dredging of the Thames River to accommodate the TRIDENT submarine.

3. Two University of Rhode Island librarians, assigned to the Naval Underwater Systems Center to apply their expertise to the Center's library and to gain experience in laboratory library operations, explored the relevance of university library procedures to the Center's library. They cataloged reports from many sources to determine their pertinence to the Center's mission and coordinated two new data bases.

B. The Community Technology Initiatives Program was established by the National Science Foundation to assist small communities in using technology to better local government. Employees, usually engineers, are assigned from the federal laboratories to these communities to identify needs and to find solutions from the resources of their own or other activities, industry, academia, or technology networks.

C. For three years ending September 30, 1979, a Navy Personnel Research and Development Center staff member served as full-time director of the San Diego Technology Action Center (SANDTAC), an action-oriented local government effort serving the needs of the city and county of San Diego by identifying and implementing new technologies applicable to municipal problems, increasing operating efficiency, and reducing costs. The director responded to diverse requests, operated the Tech Note Service which informed local departments of relevant innovations, and initiated or assisted in several projects with cost-saving potential.

Based on a review of significant requests for assistance in FY 1978 and FY 1979, SANDTAC documented cost savings of over $200,000 per year, in addition to providing direct support in improving operating efficiency.

SECTION 4

MEANS OF DISSEMINATING INFORMATION ON NAVY TECHNOLOGY

I. FOCAL POINTS

A network of Technology Transfer Focal Points at approximately 70 Navy activities forms the first line of communications with potential users and producers. The Focal Points provide general information, refer inquiries to Navy specialists, participate in technology transfer projects, and help formulate Navy technology transfer policies.

II. TECHNICAL ADVISERS

Professional staff members at Navy activities provide expertise. As examples: (1) the Naval Underwater Systems Center operates a Technical Volunteer Service comprised of 150 staff members; (2) the Naval Air Development Center provided an adviser to the Philadelphia Mayor's Science and Technology Advisory Council; (3) the Naval Postgraduate School has advised the Air Force and Army on technology transfer methods.

III. TECHNICAL PERIODICALS

The Navy publishes technical periodicals which report state-of-the-art developments in many fields. For example:

A. The monthly Navy Technical Disclosure Bulletin, produced by the Office of Naval Research, transmits technical information on Navy inventions having potential utility but not patented. The Bulletin is distributed to about 200 representatives of the Navy, federal agencies, U.S. and foreign patent offices, state and local governments, industries, universities, libraries, and other organizations.

B. The Naval Material Industrial Resources Office publishes the Manufacturing Technology Bulletin, which describes innovative manufacturing technologies and promotes their application. The Bulletin is distributed bimonthly to 1,000 subscribers in industry, government, and education.

C. The Naval Observatory publishes several almanacs, including the annual Nautical Almanac, which lists the positions of the major planets, the sun, the moon, and the brightest stars for every hour of every day. The Nautical Almanac is used by over 50,000 subscribers worldwide for navigation at sea and on land. Over 20,000 copies of the semiannual Air Almanac, which tabulates Nautical Almanac data at ten-minute intervals and contains sky diagrams arranged for pilot use, are distributed yearly.

The annual Almanac for Computers, introduced in FY 1977, provides information that enables individuals to generate astronomical and navigational data with calculators and computers, and is used by the Air Force and Canadian Forces for satellite tracking. Each year, 3,000 copies are purchased by scientists, professionals, government officials, and the public.

D. The Navy Technology Transfer Fact Sheet is distributed monthly to link developers of Navy technology with approximately 3,000 potential users in business, government, and the military. Readership has increased by more than one-third since FY 1977.

IV. CONFERENCES AND SEMINARS

The Navy sponsors or participates in technology transfer conferences, seminars, symposia, and exhibits each year.

A. In November of 1977, the Navy, Army, Air Force, and the North Atlantic Treaty Organization cosponsored an international conference on "Technology Transfer in Industrialized Countries." Over 120 military and civilian representatives of 18 countries met in Estoril, Portugal to exhange information about recent developments and current technology transfer policies, programs, and processes. The conference proceedings, Technology Transfer in Industrialized Countries, was published in 1979 by Sijthoff & Noordhoff, Alphen aan den Rijn, the Netherlands.

B. In February of 1978 the Navy Personnel Research and Development Center helped coordinate a seminar, "Energy for the Future," cosponsored by the Federal Laboratory Consortium for Technology transfer and the San Diego Technology Action Center. Over 100 local government officials attended the seminar, which focused on energy-related research and development conducted by Navy and federal laboratories.

C. The David W. Taylor Naval Ship Research and Development Center demonstrated an acoustic valve leak detector in Chicago at the National Plant Engineering and Maintenance Show and Conference in April 1978. Industrial applications cited include preventive maintenance and troubleshooting of piping systems, process monitoring in the food industry, steam leak detection to conserve energy, pollution control, and quality control of valve production. The Center subsequently received over 60 requests from conference participants for further information.

D. The Naval Air Development Center initiated and organized the "Mid-Atlantic Regional Technology and Business Opportunities Conference," held in Philadelphia, Pennsylvania in September 1979. The one-day conference provided information to the region's business community on technology transfer programs such as (a) patents and other technology available for licensing and commercialization, (b) the Navy's NICRAD (Navy Industry Cooperative Research and Development) Program, (c) computer searches for technical reports and project descriptions, and (d) procurement and small business opportunities.

E. Eight symposia were sponsored by the Office of Naval Research between January and October 1979, covering topics of interest to the Navy and civilian research communities including immunology, mechanisms of microwave biological effects, physiological adaptions to environmental stresses, and effects on health and performance of variations in work/sleep schedules.

V. DOCUMENTS

The Navy publishes technical reports and unique documents useful to the civil sector. For example:

A. In 1978 a textbook entitled Management of War Injuries to the Jaws and Related Structures was published by the Naval Medical Research Institute and based on data dating back to 1968 on the long-term results of oral and maxillofacial casualty treatment. Copies have been distributed to medical schools, health care professionals, and federal agencies and may be purchased from the Government Printing Office.

B. The Naval Aviation Executive Institute and the Naval Postgraduate School published a collection of essays entitled Technology Transfer in Science, Technology and Public Policy. The essays address such diverse areas as government policy, international technology transfer, population control and food production, computer technology, and solar heating. Copies were distributed to government agencies, libraries, technology transfer professionals, and private organizations.

VI. R&D WORK WITH TECHNOLOGY TRANSFER POTENTIAL

Ongoing R&D work with potential benefit to the civil sector is identified in the Work Unit Information System Data Bank, which is one of the Department of Defense data banks operated by the Defense Technical Information Center. Currently, 10,000 active Navy projects are on file. The Navy also submits data on patents and patent applications as a part of the Defense Technical Information Center Technical Report Data Bank. Quick, on-line searches can be made to identify technology and patent information. The Navy is encouraging extention of the full capabilities of the Department of Defense work unit and patent information system to the public. The Smithsonian Science Information Exchange and the National Technical Information Service would accomplish this through commercial data bases.

VII. SHOCK AND VIBRATION INFORMATION CENTER DIRECT INFORMATION SERVICE

The Shock and Vibration Information Center, operated by the Naval Research Laboratory, provides rapid response subscriber service which directly answers queries or provides referral to experts. In FY 1978 and 1979 over 200 substantive inquiries and over 1,000 routine inquiries from industry and government were answered. In addition, in FY 1978, the Center completed a survey and assessment of shock and vibration technology in free world countries. A similar survey for Eastern Bloc countries was begun in FY 1979. The 47th Annual Shock and Vibration Symposium was sponsored by the Center in October 1978 and was attended by 300 engineers and scientists from federal agencies, contractors, and educational institutions; approximately 80 technical programs on the latest developments in various segments of the technology were presented.

SECTION 5

DIRECT NAVY BENEFITS

Transfer of technology among Navy activities and into the Navy from the civil sector has a positive impact on Navy programs and the Navy mission.

The Civil Engineering Laboratory conducts a program for the Naval Facilities Engineering Command whereby the laboratory staff provides quick answers to technical problems facing Navy field personnel. Requests center on paints, coatings, chemicals, roofing, and building materials. Since 1971, requests have more than tripled from 190 to 600, about 70 percent of which were answered within one week.

The Office of Naval Research and the U.S. Geological Survey are developing a controlled cavitation water-jet cleaning system which removes marine growth from structures and equipment such as oil rigs and ship propellers. The system is a cost effective and efficient means of reducing a ship's drag, and consequently, its fuel consumption. A study by the Naval Sea Systems Command suggests that annual or semiannual cleaning of hulls could save the Navy more than 15 percent of its current annual ship fuel consumption, which amounts to over $200 million per year.

The David W. Taylor Naval Ship Research and Development Center obtained improved computer software developed under the industry IR&D Program for shipboard pipe design and fabrication that can result in significant cost savings (detailed piping design accounts for some 25 percent of detailed ship design costs). The computer program accesses geometric and pipe fitting data, generates drawings of possible piping arrangements and fabrication sketches, and employs error-checking modules to enhance accuracy. The Navy expects to realize cost and time savings by using the piping program in the modernization of the USS ENTERPRISE and by using the program at the Mare Island Naval Shipyard.

The integrated tug/barge concept, comprised of a detachable pusher or tug fitted into a conventional hull, evolved in the commercial maritime sector. These units can be rigidly linked together to safely operate in the open ocean. After completing two successful preliminary studies, the Chief of Naval Operations has requested more detailed technical information on applying this concept to submarine and destroyer tenders and for other non-combatant missions.

A conference on Navy Occupational Health at Battelle's Human Affairs Research Center in Seattle, Washington in January 1979 addressed issues related to implementation of Navy occupational health and safety programs and identified problem areas. Suggestions on how to structure an optimal occupational health program, as well as recommendations for enhancing the utility of occupational health information systems, improving the dissemination of health and safety information, and providing workable reward and training systems were presented. The conference proceedings have been sent to Navy industrial activities.

SECTION 6

CONCLUSIONS AND GOALS

The FY 1978 and 1979 Navy Technology Transfer Program reflects the Navy's positive and continuing commitment to secondary application of Navy-developed technology to civil agencies and the private sector. Potential users continued to seek technological guidance not available from industry with constructive results.

Based on constructive results of the FY 1978 and 1979 programs, goals have been identified for the FY 1980 through FY 1982 program within the broad objectives of the Navy Technology Transfer Program. The goals, which are supportive of the acquisition policies of OMB Circular A-109 and NATO goals of rationalization, standardization, and interoperability, are to:

- Increase the transfer of technology from domestic and foreign sources into the Navy and defense industry, concentrating on enhancing productivity in ship construction and other critical areas.
- Facilitate regional and state technology transfer through business opportunity conferences and workshops for industry and small business as a stimulus to technological and economic development.
- Initiate cooperative projects with NATO and other allies supportive of increased standardization and interoperability of weapon systems and enhanced mutual economic strength.

The Navy Technology Transfer Program has constructively benefited the national economy and helped solve national problems. Equally constructive results are expected for the Navy and the nation from programs oriented to the preceding goals. Results and expected future benefits justify continued support of the Program.

Mr. ERTEL. Thank you very much, sir.

The next witness is Colonel Ferguson, Assistant Director for Laboratories, Air Force Systems Command. Colonel Ferguson, I am prepared to take your testimony at this time.

Colonel FERGUSON. Thank you, Congressman Ertel.

I will paraphrase my statement starting off by saying that the real cornerstone of technology transfer in the Air Force is the way we conduct the program. This is significant in that three quarters of our dollars involved in science and technology are placed on contracts with either private industry, not for profit organizations or universities.

To implement the provisions of the law, we intend to utilize our scientific and technical information or STINFO offices. We will assign them an appropriate title to convey the fact that we intend to have them implement the Stevenson-Wydler Act.

At the present time, we have 17 of these people assigned full time in our 11 laboratories. It will be an additional duty assigned to them since they already have the primary function of the transfer of scientific information within our laboratories and to all people interested in science and technology throughout the country.

Section 11 requires that we conduct a technology assessment of all of the work that we have in progress. We have an existing mechanism to do that. We call it technology management review. Reviews are conducted for every in-house work unit as well as all contracts.

It is a two-level management review system. We intend to require that the opportunity for transfer of technology outside the defense community will become an item of specific interest, and we will implement this through Air Force Systems Command regulations.

That information will be documented. We will put it into our management information sytems which the STINFO officers have cognizance over so we can identify each and every one of these efforts that has application outside of the defense community.

We believe we are in compliance with other provisions required by section 11. This is said in the context of the OSD waiver. We will continue to aggressively provide opportunities to transfer technology and to provide services as requested from local government agencies.

It was mentioned earlier that in New Mexico there will be the Showcase for Technology. Our Air Force Weapons Laboratory is a participant in that.

Another illustration of how we do participate in these kinds of activities is our Rome Air Development Center at Rome, N.Y. They just completed a 3-day conference. There were over 500 participants in that conference. The last day was devoted to briefings for small and disadvantaged businesses.

The technology transfer program associated with our manufacturing methods technology [MANTECH] efforts is also an excellent program. We require in every one of those contracts that there be a demonstration open to all companies, all interested personnel, wherein the products, be it hardware or processes, are demonstrated for all who care to come.

We also provide services requested at the local level. We intend to continue with these within the abilities of our laboratories to accomplish their primary mission.

Thank you.

[The prepared statement of Colonel Ferguson follows:]

PUBLIC LAW 96-480

"STEVENSON-WYDLER TECHNOLOGY INNOVATION ACT OF 1980"

STATEMENT

OF

COL THOMAS R. FERGUSON, JR.

ASSISTANT DIRECTOR OF LABORATORIES

AIR FORCE SYSTEMS COMMAND

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY

COMMITTEE ON SCIENCE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

16 JUL 81

NOT FOR PUBLICATION UNTIL
RELEASED BY THE COMMITTEE

MR..CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

I, ALSO, AM PLEASED TO HAVE THE OPPORTUNITY TO DESCRIBE BRIEFLY THE AIR FORCE ACTIVITIES UNDERWAY TO MEET THE REQUIREMENTS OF THE STEVENSON-WYDLER ACT. COL FRIDAY HAS DESCRIBED DOD'S POSITION AND WAIVER OF THE STAFFING AND FUNDING REQUIREMENTS. MY COMMENTS, THEREFORE, PERTAIN TO AIR FORCE PLANS WITH REGARD TO OFFICES OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA) AND THEIR SPECIFIC FUNCTIONS.

BUT FIRST I SHOULD LIKE TO REVIEW THE PHILOSOPHY AND STRUCTURE OF THE AIR FORCE SCIENCE AND TECHNOLOGY PROGRAM. BECAUSE INDUSTRY, AND NOT OUR LABS, BUILDS THE HARDWARE WE FLY, WE TRANSFER TECHNOLOGY LARGELY THROUGH THE WORK OF OUR CONTRACTORS. DOLLARWISE, 76% OF OUR FUNDS ARE INVESTED ON CONTRACT. A BREAKDOWN OF THE APPROXIMATELY 3,600 ACTIVE LABORATORY CONTRACTS SHOWS 2,700 WITH INDUSTRY, 675 WITH EDUCATIONAL INSTITUTIONS, 160 WITH NON-PROFIT FOUNDATIONS, AND 50 WITH FEDERAL AGENCIES. OF THE 2,700 INDUSTRY CONTRACTS, 1,735 ARE WITH LARGE BUSINESSES, 338 WITH SMALL BUSINESSES, AND THE BALANCE ARE NOT SPECIFICALLY CLASSIFIED. THESE CONTRACTS TOUCH ALL CORNERS OF THE UNITED STATES AND LITERALLY BECOME THE GREASE WITH WHICH WE LUBRICATE THE TECHNOLOGY TRANSFER MECHANISM.

TO ASSURE NEW TECHNOLOGY SPREADS BEYOND THE MATRIX OF CONTRACTORS JUST DESCRIBED, WE ESTABLISHED THE AIR FORCE SCIENTIFIC AND TECHNCIAL INFORMATION PROGRAM, BETTER KNOWN AS THE STINFO PROGRAM. ITS DUAL

PURPOSE IS TO ENSURE THAT (1) SCIENTIFIC AND TECHNICAL INFORMATION MAKES THE MAXIMUM IMPACT ON THE ADVANCEMENT AND DEVELOPMENT OF AIR FORCE TECHNOLOGY, AND (2) THE SCIENTIFIC AND TECHNICAL INFORMATION GENERATED UNDER AIR FORCE R&D PROGRAMS MAKES MAXIMUM CONTRIBUTION TO THE NATIONAL ECONOMY. TO FULFILL ITS MISSION OBJECTIVES, THE STINFO PROGRAM OPERATES IN CONJUNCTION WITH THE DATA MANAGEMENT PROGRAM, THE PUBLIC INFORMATION PROGRAM, THE TECHNICAL INTELLIGENCE PROGRAM, AND THE FOREIGN DISCLOSURE PROGRAM. STINFO OFFICES HAVE BEEN ESTABLISHED AT AIR FORCE SYSTEMS COMMAND SUBORDINATE HEADQUARTERS, DIVISIONS, CENTERS, LABORATORIES, AND AT OTHER MAJOR COMMANDS SUCH AS AIR FORCE LOGISTICS COMMAND, AIR UNIVERSITY, TACTICAL AIR COMMAND, STRATEGIC AIR COMMAND, MILITARY AIRLIFT COMMAND, AND THE AIR FORCE INSTITUTE OF TECHNOLOGY. WE INTEND TO FUSE THE ORTA FUNCTION WITH THIS EXISTING STRUCTURE. WE WILL ATTEMPT THIS WITH NO INCREASE IN MANPOWER.

NOW SOME COMMENTS ON THE ORTA FUNCTIONS. THE APPLICATION ASSESSMENT CALLED FOR IN SECTION 11 WILL BE INCORPORATED INTO OUR ROUTINE LABORATORY PROGRAM REVIEW SYSTEM. EACH LABORATORY COMMANDER DURING HIS EXISTING TECHNICAL MANAGEMENT REVIEWS WILL IDENTIFY PROJECTS APPLICABLE TO THE NON-DEFENSE COMMUNITY--LOCAL AND STATE GOVERNMENTS AND PRIVATE INDUSTRY. THESE ASSESSMENTS WILL THEN BE FORWARDED TO THE SCIENTIFIC AND TECHNICAL INFORMATION OFFICES.

WE WILL ALSO CONTINUE TO ENGAGE ACTIVELY IN TECHNOLOGY TRANSFER THROUGH THE MANY AVENUES ALREADY OPEN. FOR EXAMPLE, THE LABORATORIES ARE ACTIVE

PARTICIPANTS IN THE FEDERAL LABORATORY CONSORTIUM, DEFENSE TECHNICAL INFORMATION CENTER, AND THE NATIONAL TECHNICAL INFORMATION SYSTEM. WE HAVE LONG HAD A COMPUTERIZED MANAGEMENT AND SCIENTIFIC INFORMATION SYSTEM THAT AUTOMATICALLY FEEDS THESE INSTITUTIONS WITH UP-TO-DATE STATUS ON BOTH IN-HOUSE AND CONTRACTED LABORATORY WORK. WE INPUT DATA TO THE DEFENSE LOGISTICS AGENCY'S INFORMATION ANALYSIS CENTERS WHICH PROVIDE SPECIFIC, TAILORED ADVICE TO CUSTOMER INQUIRIES. WE ALSO CONTRIBUTE TO THE PATENT ABSTRACT DIGEST AND THE ABSTRACT OF NEW TECHNOLOGY. BESIDES THE PUBLICATION OF TECHNICAL REPORTS ON ALL OUR WORK, WE ALSO PURSUE LOCAL INITIATIVES. THESE INCLUDE LABORATORY "OPEN-HOUSE" MEETINGS WITH INDUSTRY, YEARLY PUBLICATION OF LABORATORY TECHNICAL PLANS LISTING LAST YEAR'S ACCOMPLISHMENTS AND SHOWING FUTURE-YEAR PLANS, SUPPORT OF INFORMATION FOR INDUSTRY OFFICES WHICH PROMOTE LABORATORY WORK FOR INDUSTRY, AND THE POTENTIAL CONTRACTOR PROGRAM WHICH WAS ESTABLISHED TO CERTIFY AND REGISTER NON-GOVERNMENT ACTIVITIES FOR ACCESS TO CONTROLLED SCIENTIFIC AND TECHNICAL INFORMATION.

ALTHOUGH OUR ASSIGNED MILITARY MISSION IS PREEMINENT, WE ALSO HAVE A HISTORY OF WORKING EFFECTIVELY WITH LOCAL AND STATE GOVERNMENTS. WE WILL CONTINUE THAT SERVICE. WE BELIEVE OURS IS A TRADITION FULLY CONSISTENT WITH PUBLIC LAW 96-480. WE WILL WORK TO IMPROVE THIS SUPPORT AS THE LAW REQUIRES.

Mr. Ertel. Thank you, Colonel Ferguson.

You indicated you have an open demonstration at the end of each MANTECH project and that is available to anyone. I am curious as to how you notify the manufacturing community or the business community or whatever community might be able to use those techniques.

Not that I am the one you would normally notify, but I wondered how you disseminate that notification and what selective groups that would go to.

Colonel Ferguson. It has been a selected group. The mailings have been to those people we judge to have an interest in the technology. In further keeping with the intent of the act, we intend to require that those demonstrations be readvertised in the Commerce Business Daily and to try to get wider notification of the fact that we intend to conduct a demonstration.

Mr. Ertel. In previous hearings before this subcommittee, testimony has been given which indicated DOD personnel were RIF'd or demoted from the technology transfer activities. The rationale for this was that technology transfer is not a DOD mandate.

Work was not directed at DOD responsibilities. Therefore, the job and/or the person was not necessary and therefore subject to termination. The Stevenson-Wydler Act provides a mandate.

Do you see the situation just described as a thing of the past?

Colonel Friday. Mr. Chairman, I certainly hope it is a thing of the past. As you know, one of the problems that we face in the Department of Defense in particular and several of the other mission agencies, is that we are charged with very unique, very specific missions.

As was pointed out by Dr. Berman earlier today, we have certain contracts if you will, that we must satisfy, both with the Executive Office and with Congress in carrying out our mission. In the past in some of the areas when reductions in force did occur, we took a look across the board at those areas which could be eliminated, those areas which were contributing less to the DOD national security mission than others.

In the past, some of the positions for technology transfer were considered soft in comparison to the other missions required to be performed by the Department of Defense laboratories. The Stevenson-Wydler Act does indeed assign this responsibility to all Federal laboratories.

I doubt seriously, although I am certainly not going to tell you it will never happen again, I doubt seriously if that will happen again.

Mr. Ertel. It seems to me, and I am no defense expert, but part of our defense depends on the economic and industrial strength of this country.

I think moving innovations out of the research laboratories and getting them into the hands of the people—and this laboratory is one of the largest in the world, probably about $20 million this year—is very important.

It seems to me that you have a unique responsibility in that regard to transfer that available technology which isn't national-security classified to the industrial sector and keep that part of our national defense and our national effort strong.

I would suggest that maybe you ought to look at the increase in the defense budget, and the R. & D. budget, as a way to utilize some of that money in technology transfer. Do you know of any plans to do that?

Colonel **Friday**. We do not have any line items in the budget for technology transfer or in the research and development budget as I am sure you are aware. As indicated by Dr. Berman and by the other representatives here, we are assigning specific officers the responsibility for technology transfer within the laboratories.

The total budget, the $20 billion, as you indicated, is a little misleading. Those dollars are budgeted and targeted primarily for specific systems. Those are probably not applicable to technology transfer, although some of the technology would be.

Within the technology structure of the Department of Defense which is a substantially smaller portion of that R. & D. budget, approximately 3 to 3½ billion dollars is——

Mr. **Watkins**. Could the Chairman yield right here on something?

Mr. **Ertel**. Of course.

Mr. **Watkins**. I would like to point out that you are technically correct when you say you don't have a line item in there. The Stevenson-Wydler Act, mandates 0.5 percent to be set aside to be used for technology transfer.

I concur that it is not a line item. But if we fulfill the mandate, and not just say we are fulfilling the spirit, then we will set aside 0.5 percent to carry it out.

Colonel **Friday**. Deputy Secretary Carlucci in his response to the House and Senate with respect to this bill indicated that he is of the opinion that we are in fact fulfilling that requirement at the present time. Now admittedly, that evaluation along with the 1982 budget was done without a great deal of time, and we are in the process of evaluating exactly what we are doing in the light of technology transfer and how those funds, those manpower are charged off against the Stevenson-Wydler intent.

Mr. **Watkins**. I yield back.

Mr. **Ertel**. I had a question. You talked about the defense systems, such as the MX system. A lot of that is not information that can be transferred. I wondered if that is a correct statement, because you have a lot of subsystems there. The subsystems make one system. Each of those subsystems has some relevance to the industrial sector, whether it is a guidance system or a computer system or a propulsion system.

I really question that. I have heard that from the military before that we do such large systems, that there are so many things that really are not appropriate to transfer to the private sector. I have to say to you that man is clever and he can adapt some of those systems to a lot of wide parameters.

That is why we want technology transfer and we want the widest possible spectrum to give man the ability to use some of those things that we might not envision in the private sector.

Colonel **Friday**. I agree with the intent of your statement. I would like to point out that those subsystems had their origin in the technology base program in the laboratories. By the time we get to the engineering development of a system such as the MX or the Trident, we are beyond subsystems.

We are integrating subsystems in the engineering stage. We do have a manufacturing technology program which is $150 million this year, $170 million next year, which is addressing those unique sorts of things as manufacturing of these large systems, how do we go about improving the productivity of the manufacturing plant, and so forth.

How do we improve the productivity of building the systems we are talking about? That is a part of the technology transfer function that DOD has. The point with the large systems, the large block of money going into the development of major strategic programs versus the technology program going on in the laboratory, was what I was trying to draw a distinction about, whether we are talking about the $20 billion which is the total DOD budget for R. & D. or whether we are talking about our basic research and our technology demonstration programs, which is approximately $3½ billion this year.

Mr. Ertel. I asked an awfully lot of questions there. Has any of the increased funding for R. & D. been slated to be used for technology transfer?

Colonel Friday. I don't have a specific answer to that. Dr. Berman has already assigned two people to that within the Naval Research Laboratory. The other laboratories are now establishing parts of their scientific and technical information offices.

So part of this will undoubtedly come out of overhead funds for the laboratories, out of R. & D. budgets. It cannot be done for nothing. It will come out of increased funding, but specific figures associated with that are not available.

Mr. Ertel. I noted in Dr. Berman's testimony, you indicated that we ought to maybe fund directly from the Federal funds for the technology transfer and research and development. Do you see an absolute need for that, or is the military establishment capable of doing technology transfer without that?

Dr. Berman. I think we are capable of doing it without setting it up.

Mr. Ertel. Do you have the incentive to do it?

Dr. Berman. Under the law, yes.

Mr. Ertel. We know that there is a stick and there is a carrot. The law can beat you over the head. You can do things reluctantly. But is there any enthusiasm?

Dr. Berman. Yes. The point is that the only reason a laboratory such as the one I am affiliated with is in business is to eventually produce systems for the service. We are not participating in these various programs strictly out of altruistic motives.

For example, we would like to have cheaper and faster welding available to build Navy systems. So we really have a very intense interest in transferring this technlogy to the civilian sector. A great deal of transfer went on before the law and I think would go on whether or not a sum of money is mandated.

Part of the problem is we do live in a bureaucratic world where compliance is measured in numbers and percents. The basis, as Colonel Friday has said, of what constitutes a half a percent of what is uncertain. Various systems procurement come under appropriations and we get money from other agencies on a tasking basis. It is not clear to me whether I have to to tax a task I have contracted to complete for DOE.

I find myself on occasion somewhat in the position of feeling is guilty of committing the crime of conversion. That is, if the will of Congress is that money be spent for some non-mandated purpose it is not clear to me that I have authority to arbitrarily take money that was given to the laboratory to perform a task and use it for some other purpose even though Congress in the Stevenson-Wydler Act said we should do so. From my perspective I feel uncomfortable with the situation.

Mr. **Ertel**. You have been given a mandate by the law to do it. I can't say you are converting in any way.

Dr. **Berman**. If an appropriation is to be used for whatever purposes the Appropriations Act says it should be used for, then if I take funds for one appropriation and use it for some other purpose I may be in a somewhat awkward position. I get different readings from different counsels about that.

Mr. **Ertel**. We have been noted to do that. [Laughter.]

Mr. Watkins?

Mr. **Watkins**. Thank you for letting me join the committee. One of the big criticisms we have in this country of the Federal Government, is the Government's attitude of not saying "how can we solve this to the best interests of the people," but "how can we work around it and not implement it."

I think the act is very clear. I would like for you to indicate under the law what you think that 0.5 percent is and submit it to this subcommittee.

If there is some misunderstanding, we may be able to get that clarified a little bit further.

I think you may want to look at NASA, which has served with great distinction as this room attests to, regarding what they are doing, because the Congress had the foresight to say to NASA—and they have as sophisticated technology as any group out here—"we want you to try to transfer that technology."

These four mandates are indicated in the law and we have seen what NASA has been able to do. This has repaid the taxpayers and society, the people who have to pay the dollars to try to support defense and everything else.

I would like to encourage you to look at NASA. I would like also to encourage you to look at agriculture. They have been in this position for years. Let's look at what agriculture has been able to do. It is the only area of our economy in this country that is keeping us half way solvent in the area of balance of trade. Let me mention again, the Department of Agriculture used 10 percent of their research and experimental money for dissemination and technology transfer.

Could that be the reason why, with only 3 percent of our population being farmers, we feed this entire country with a less percentage of our disposable income than any country of the world, and we feed one-third of the world besides?

I think we have got a lot of examples we can look at. What worries me is that productivity has been on the decline. There are a lot of reasons for that. But one might be that we have not done the job in getting tremendously capable people that we have in the Government to be able to disseminate that information.

Let me point out Agriculture has people out there established. They have it so it gets to the people. They have the extension people, the experimental farms, and that information gets out there to people so they can actually use it.

We haven't made that effort. Yes, maybe they can come and get it, but most people in my area, they don't even know there is even opportunity for it.

I think we have an obligation through the Stevenson-Wydler Act, to make an effort, to make more of an effort.

I talked to Tom Stafford about this at great length and I think he shares the views we have. I will be talking to the Secretary of the Army this afternoon on another matter and I will bring this up, also.

I know the Department of Defense asked for a waiver, I would like to ask also for you to submit what you are planning to do, other than what you are doing now, to try to meet the Stevenson-Wydler Act's requirements.

I can see certain areas of waiver—national security, defense, that sort of thing. The biggest thing we are worried about today is the economy, and our productivity, and inventions, and patents.

I have a particular interest in the Corps of Engineers. I am on the Appropriations Committee and I am on the Water and Energy Subcommittee which has jurisdiction over the Corps of Engineers.

I wish they were given more credit in some areas. They have received a lot of criticism. This morning you mentioned the Corps is one of the key players in the Army's technology transfer programs. I was of that opinion also, and through my appropriations subcommittee asked the Corps to detach a person to the southwest division. A pilot program is going on in that area to demonstrate the implementation of Public Law 96-480.

I was hoping this act could work for technology transfer and industrial innovation in the rural depressed area. I am going back to the basics of trying to build jobs and I can't get industry to a rural depressed area.

That is why I am concerned about the technology transfer problem. It is such a crusade for me because I am convinced that everything you see in this room at one time was an idea. Everything you got on at one time was an idea. In order to put it in action, to put it to work, the first question you have to ask is, can you technically build it?

If you can technically build it, you have to find out where the answers are. Right today, we haven't disseminated all those answers. That is the first question.

The second question is, can you market it? If you can technically build it and you can market it, you have the availability of a new product in this country. We have a lot of new industries, Mr. Chairman, from NASA. They solve a lot of present problems of existing business and industry.

Did you know that two thirds of the inventions in this country come from the small businessman?

The farmer? The skilled worker? Not where we are sending all the money. That is what we are trying to say, 0.5 percent. I wanted

5 percent, but we couldn't get it. We finally got 0.5 percent. Two-thirds of the inventions are being invented by people who do not have access to that capital.

Why? Because the crisis is the mother of invention. Necessity is the mother of invention. It is not the Fortune 500 presidents or chairmen that run into the crises. It is the skilled worker out there trying to make the welder or something else work.

He is the one that does it the better way. I apologize for preaching the gospel a little bit. But I am trying to point out why I think it is important that this Government and the Department of Defense take a positive look at the contributions that I think you gentlemen could make in solving an economic and productivity problem in our country.

Agriculture has done it. They do the research and then they get it out through extension. I was an FFA farm boy implementing new fertilizers and new hybrid seeds as a youngster. That was done in the research laboratories, some Federal laboratory, or in a land grant university.

It is a different approach to it. That is what I am asking you to look at. Say to yourself, hey, we have got a lot to offer. We could make a tremendous impact. I would like to get that Corps of Engineers person out there in a manner of trying to activate and generate, not just wait and see.

I hope you will take a strong look at that because my motive is pure in what we are trying to do for this country. If we can't give birth to it, then we might as well write those people off in this country.

Dr. VERDERAME. I will be happy to look into the problem and get the specifics of where you might want the Corps of Engineers to interact with the local or State governments and provide information.

[The information follows:]

The Corps of Engineers is strongly committed to and is providing information and technology transfer to local and state governments, industry and the universities of applicable products developed in its research and development program. In reviewing the alternatives for the most efficient and effective ways of accomplishing this objective, it has been determined that the Corps will, in cooperation with appropriate civilian agencies, sponsor a Science and Technology Transfer meeting at an appropriate location in the Southwest Division, to be attended by representatives of civilian industry, universities, State and local governments. The Corps research and development performing elements would make detailed presentations on the most current products which are applicable and ready for transfer, answer questions and provide points of contact for follow-up discussions. They would also provide an overview of their programs so that the participants will be better informed on Corps capabilities. Subsequently, Science and Technology Transfer meetings will be held periodically to address new developments. This approach to enhancing technology transfer of federally funded research to the public will be discussed with Congressman Watkins staff at a meeting scheduled for August 5, 1981. It is similar to activities participated in by the Corps R. & D. performing elements in other parts of the country over the last few years, all of which have been successful in making the general public aware of new technology from which they could benefit.

Mr. WATKINS. I would deeply appreciate that. I have told the President's people, they say we are going to cut out this feature. They say the private sector is going to pick up the gap. Hell, I don't have a private sector in the rural depressed area where I am from. I don't know what we are going to do.

I guess we can continue doing what we have been doing, living on a per capita income of $4,000 in the rural depressed area. I would like all of you to look at that from a positive angle because I try to see it positively. I would like you to find ways of how you can say yes, 0.5 percent of—and we can set that as a goal and try to get as much of that one-half of 1 percent utilized as we can.

We recognize that we have to waive this because of——

Mr. ERTEL. Would you yield?

Mr. WATKINS. Yes, sir, I yield. It is a privilege to yield. [Laughter.]

Mr. ERTEL. I just might point out that I have some problems with the analogy to agriculture because agriculture is the prime client. The Agriculture Department is a farmer. We have the entire thrust of our research and development in the farm area. I understand that your function is really to send to the Military Establishment.

That is your primary function. I think that NASA is probably, as you point out, a much better example for you because NASA's primary function is to do the things you see in this room.

On the other hand, NASA has had from everything I know, an excellent technology transfer system. Certainly I am not saying NASA is perfect. I guess that brings us to the question.

Do you see a need for a central clearinghouse such as has been designed at the Office of Industrial Technology within the Stevenson-Wydler Act? Would that in fact assist you or would that be a way in your judgment to do the transfer and be more helpful?

Colonel FRIDAY. I think that there needs to be some central point that anyone who needs to address the technology available in the Federal sector can come to. Whether or not that should be the Federal Laboratory Consortium or the centers you are talking about, I don't know.

But there needs to be a central point of contact.

Mr. ERTEL. I am glad you brought up the Consortium because that is losing funding. Is the Department of Defense willing to put additional funding into that Consortium?

Colonel FRIDAY. We will continue to support it. I can't commit to additional funding.

Mr. ERTEL. I want you to look at that because we need something such as that. That can serve the function he is talking about within the Department of Agriculture to move that information into that private sector where he wants it and where I want it and where you want it, frankly, for a strong industrial America, which I think is still one of your ultimate jobs.

I took some exception to statements I heard from the table. You say we are not altruistic. Dr. Berman said that. I got to say to you, you better be. You are Government employees. You are no different than I am. And yes, you want to serve your primary function which is to improve your sector or your business.

But still a little altruism on your part helps us all. That is the whole function.

You know, you are not just to serve that little sector, whether it is the Naval Research Laboratory or X, Y, or Z. The whole segment fits within your role. I am not going to give you a speech. [Laughter.]

I think that is an attitude that I don't think should be encouraged among Federal employees, and you are Federal employees, whether you are military or not. I think you ought to have a broader spectrum.

Colonel **Friday**. With regard to the statements made by Mr. Watkins, I appreciate the concern. Believe me, if we come across negative here, we didn't intend to. I agree entirely with the necessity of strengthening this country. It is not only me that agrees with that, but the Secretary of Defense and every level of management within the Department of Defense firmly supports that.

We have been involved very strongly in technology transfer in the past. It was pointed out by Dr. Verderame that the original computers were designed to figure out how to plan artillery fire in World War II.

We are starting a new program now within all services on the very high-speed integrated circuitry because we are concerned about the economic and industrial health of this country. We are concerned about the fact that those technologies are falling behind in electronic circuitry, for example, to other nations, that we are no longer leading the technology development in this area.

We are initiating a major program, over $250 million in the next 3 or 4 years, to develop the technologies within this country through a broad base of industry for very high-speed integrated circuitry to increase by order magnitude the ability of integrated circuitry today.

With respect to your discussion of NASA, we transferred to NASA much of that technology early in the game. That transfer was to other Federal laboratories. That is not what we are addressing today, but we are involved in that.

The Corps of Engineers Cold Regions Research and Engineering Laboratory formed the basis of much of the technology upon which the Alaskan pipeline was built. The Air Force Geophysics Laboratory works on Doppler radar which will form the basis for the radar going in across the Nation over the next decade.

Mr. **Watkins**. Many agencies have tended to cite as technology transfer success stories examples where technology found its way into the public sector, but did not start out that way. I would like to say that this committee's report makes it very clear that this does not satisfy the requirements of the act.

The overriding consideration in making a determination as to what should be categorized as technology transfer is the activity so classified should be dedicated to technology transfer from the outset. I would like to say from my standpoint, and I am very optimistic, that if we go with a positive attitude and have some meetings today and work, we can come to that 0.5 percent and have a real constructive effort.

I want to assure you that on the Appropriations Committee, I will be asking my friend Joe Addabbo, the chairman of the Defense Subcommittee, probably for an investigation somewhere down the line to see what we have done to meet these four things set out in Stevenson-Wydler.

Thank you, Mr. Chairman.

Mr. **Ertel**. We will be looking forward to seeing the responses to that when it is accomplished, too. We will be looking forward to seeing that the Defense Department Establishment does the things outlined in Stevenson-Wydler.

Thank you very much, gentlemen, for participating. We will hope to see you again and you will be able to give us an affirmative response to technology transfer programs in the implementation of Stevenson-Wydler.

The committee will stand in recess for 10 minutes until we vote. We will reconvene at a quarter of the hour.

[Recess.]

[Further questions were submitted to all members of the panel in writing. The questions and responses follow:]

Questions from the Subcommittee on
Science, Research and Technology

1. The Stevenson-Wydler Act requires that an Office of Research and Technology Applications (ORTA) be established at each Federal laboratory. This requirement may not be waived although laboratories having existing organizational structures which perform the functions of the Office may elect to combine the Office within the existing organization.

   (a) Please provide the Subcommittee with a list of Federal laboratories owned and funded by your agency (whether or not operated by your agency).

   (b) For each laboratory on the list described in (a) please give

      (i) the total annual budget for FY 1981

      (ii) the name, title, address and telephone number of the chief staff person for the Office of Research and Technology Applications. If the ORTA is combined with an existing organizational structure, name the structure.

2. (a) What is your agency's total research and development budget for FY 1982 expected to be?

   (b) What is your agency's total budget for the technology transfer function, as defined by the Stevenson-Wydler Act and House Report 96-1199, expected to be for FY 1982?

   (c) Please provide a breakdown of the technology transfer budget (as described in (b) above) into whatever detail is used to calculate it.

Submitted by MR. WATKINS

1. There seems to be quite a misconception among the agencies as to what Congress intended when it mandated technology transfer in Section 11. Technology transfer was defined, for purposes of the Act, as the four functions listed in Section 11 (c). These functions are:
   1) Preparation of application assessments for R & D projects.
   2) Provide and disseminate information.
   3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community.
   4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

It is important to stress that "information dissemination" comprises only one-fourth of our definition of tech transfer. In fact, during the hearings from which the legislation was developed, we discovered that a number of labs and agencies were disseminating information, but very few were taking the other three steps.

Please provide for the record a breakdown of all the tech transfer activities you have cited as satisfying the requirements of the Act, and indicate into which of the four classifications each falls.

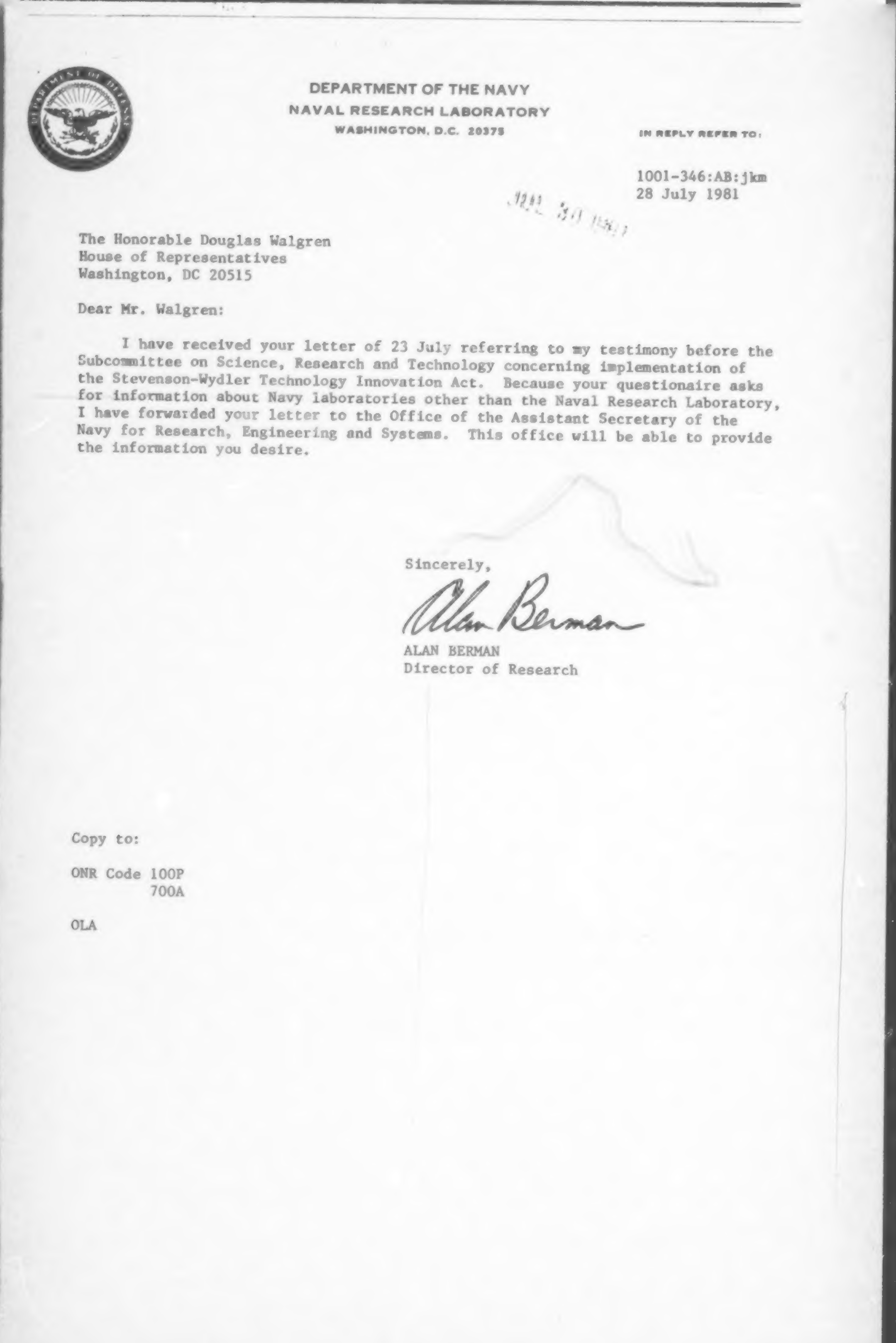
Questions by Mr. Watkins

2. Many agencies have tended to cite as tech transfer "success stories" examples where technology found its way into the public and private sectors, but did not start out as direct tech transfer activities.

   This Committee's report which accompanied the Act makes it very clear that this does not satisfy the tech transfer requirements of the Act. Let me quote from Page 32 of the Report:

   > "...(T)he overriding consideration in making a determination as to what should be categorized as technology transfer is that the activity so classified should be dedicated to technology transfer _from the outset_ (emphasis added)."

   Based on _that_ definition, how much of the tech transfer activities you've taken credit for this morning would still be considered tech transfer for the purposes of the Act?



DEPARTMENT OF THE NAVY
NAVAL RESEARCH LABORATORY
WASHINGTON, D.C. 20375

IN REPLY REFER TO:

1001-346:AB:jkm
28 July 1981

JUL 30 1981

The Honorable Douglas Walgren
House of Representatives
Washington, DC 20515

Dear Mr. Walgren:

I have received your letter of 23 July referring to my testimony before the Subcommittee on Science, Research and Technology concerning implementation of the Stevenson-Wydler Technology Innovation Act. Because your questionaire asks for information about Navy laboratories other than the Naval Research Laboratory, I have forwarded your letter to the Office of the Assistant Secretary of the Navy for Research, Engineering and Systems. This office will be able to provide the information you desire.

Sincerely,

Alan Berman

ALAN BERMAN
Director of Research

Copy to:

ONR Code 100P
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DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
(RESEARCH, ENGINEERING AND SYSTEMS)
WASHINGTON, D.C. 20350

30 SEP 1981

The Honorable Douglas Walgren
Chairman, Subcommittee on Science,
Research and Technology
House of Representatives
Washington, D. C. 20515

Dear Mr. Walgren:

Your letter of 23 July 1981 to Dr Berman of the Naval Research Laboratory requested information on implementation of the Stevenson-Wydler Technology Innovation Act of 1980 (PL 96-480). Inasmuch as your questions concerned all Navy laboratories, your letter was forwarded to this office for response.

As permitted by the Act, the Secretary of Defense has exercised his option to waive the funding and personnel requirements of Section 11 (b) of the Act. Information on the remaining aspects of your questions applicable to the ten Navy laboratories is attached. The dollar totals in the summary, however, must be qualified by caveats similar to those expressed by Dr Berman in his testimony before your Subcommittee. In particular, the Navy laboratories are funded on an industrial basis. "Annual budgets," therefore, are more appropriately termed "annual expenditures." Also, these expenditures are not derived exclusively from within the Navy because services of the laboratories are procured by other government agencies in addition to Navy R&D managers.

Should you require additional information with respect to the Navy laboratories, this office will be pleased to assist.

Sincerely

GERALD A. CANN
Acting Assistant Secretary of the Navy
(Research, Engineering and Systems)

NAVY LABORATORIES
(DOLLARS IN MILLIONS)

LABORATORY	FY 1981 RDT&E,N BUDGET[1]	FY 1981 TOTAL BUDGET[1]	FY 1982 PROJECTED RDT&E,N BUDGET[1,2]	FY 1982 PROJECTED TOTAL	ORTA CONTACT	OFFICE & TITLE	ADDRESS	TELEPHONE
NADC	162.6	226.0	181.7	284.1	Mr. Jerry Bortman	Technology Transfer Coordinator	Code 7012 Naval Air Development Center Warminster, PA 18974	(215) 441-3100
NCSC	46.8	63.3	59.6	69.9	Mr. John Hart	Head Program and Management Planning Office	Code 120 Naval Coastal Systems Center Panama City, Fl 32407	(904) 234-4393
NOSC	172.4	259.6	188.6	279.4	Dr. Eugene Cooper	IR/IED Technology Office	Code 013 Naval Ocean Systems Center San Diego, CA 92152	(714) 225-7455
NPRDC	17.9	21.7	22.4	26.6	Mr. Harold H. Rosen	Technology Transfer Coordinator	Code 303 Navy Personnel Research and Development Center San Diego, CA 92152	(714) 225-7109
DTNSRDC	138.6	185.8	151.0	190.8	Dr. Basil Nakonechny	Office of the Director of Technology	Code 012.2 David W. Taylor Naval Ship Research and Development Center	(202) 227-1037
NSWC	195.2	327.0	213.7	364.3	Dr. Sherman Gee	Technology Transfer Coordinator	Code D21 Naval Surface Weapons Center, White Oak Silver Spring, MD 20910	(202) 394-1505

LABORATORY	FY 1981 RDT&E,N BUDGET[1]	FY 1981 TOTAL BUDGET[1]	FY 1982 PROJECTED RDT&E,N BUDGET[1,2]	FY 1982 PROJECTED TOTAL BUDGET[1,2]	ORTA CONTACT	OFFICE & TITLE	ADDRESS	TELEPHONE
NUSC	211.1	388.0	225.7	409.5	Mr. Michael Ahrens	Head, Office of Special Programs Development	Code 0702, BLDG 80T Naval Underwater Systems Center New London, CT 06320	(203) 447-4908
NWC	198.7	320.4	217.8	355.1	Mr. George Linsteadt	IR&D/Technology Utilization Office	Code 3803 Naval Weapons Center China Lake, CA 93555	(714) 939-2305
NRL	192.0	244.0	189.8	265.0	Mr. Richard Fulper, Jr.	Head, Office of Research and Technology Applications	Naval Research Laboratory Washington, DC 20375	(202) 767-3726
NORDA	32.8	36.6	41.1	45.7	Mr. George E. Stanford	Technology Transfer Coordinator	Naval Ocean Research and Development Activity NSTL Station, MS 39529	(601) 688-4790

1. "Budget" refers more correctly to "expenditures" for FY 1981 and for "expected expenditures" for FY 1982.

2. FY 1982 data is based on budget submissions made last year. FY 1982 budget is being revised but new budget figures are not yet available.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE SYSTEMS COMMAND
ANDREWS AIR FORCE BASE, DC 20334

12 AUG 1981

Honorable Doug Walgren
Chairman, Subcommittee on Science,
Research and Technology
Committee on Science and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Walgren

In response to your letter of 23 July 1981, attached is a list of Air Force laboratories, the FY 81 annual budget of each, and the name and address of the Office of Research and Technology Applications (ORTA) focal points. Since the ORTA function is being incorporated into the existing Scientific and Technical Information (STINFO) program function at each laboratory, each focal point is also the laboratory STINFO officer.

The research and development (R&D) budget for the Air Force laboratories is derived from the total annual budget estimate by deducting civilian salaries, reimbursements, and expected funding from other than the R&D appropriation. Reimbursements are funds supplied by non-laboratory organizations for services provided in direct support. In FY 81, annual funding includes $145.6 million for civilian salaries and $369.8 million in reimbursements and funding from non-R&D appropriations, leaving R&D funding of $845.8 million.

The FY 82 total R&D budget will be about $984.0 million (i.e., annual budget of $1,516.2 million minus reimbursements, salaries, and non-R&D appropriation funding). Of this amount we expect $6.34 million, versus the minimum amount required by legislation ($4.92 million), will be expended for technology transfer as follows:

STINFO/ORTA Function	$6.11M
Air Force Information for Industry Office/ Air Force Potential Contractor Program	.07M
Participation in the Federal Laboratory Consortium for Technology Transfer	.15M
Patent Licensing Program	.01M

Should you need additional information, we would be pleased to give you whatever assistance we can.

Sincerely

TR Ferguson

THOMAS R. FERGUSON, Jr., Col, USAF
Asst Director of Laboratories

1 Atch
Laboratory List, 31 July 1981

31 July 1981

LABORATORY	FY 81 ANNUAL BUDGET ($M)	ORTA FOCAL POINT
Air Force Wright-Aeronautical Laboratories	540.5	Mr. James Johnson AFWAL/TST Wright-Patterson AFB OH 45433 (513) 255-5804
Provides common laboratory management, support functions, and command and staff elements for:		
- Flight Dynamics Laboratory	102.8	
- Aero Propulsion Laboratory	121.6	
- Avionics Laboratory	175.8	
- Materials Laboratory	140.3	
Air Force Office of Scientific Research	134.0	Mr. Matthew Kerper AFOSR/XOPD Bolling AFB DC 20332 (202) 767-4969
Frank J. Seiler Research Laboratory	.9	Maj T. Dale Baxter FJSRL/XO USAF Academy CO 80840 (303) 472-3120
Air Force Geophysics Laboratory	63.0	Ms Noreen A. Dimond AFGL/XOP Hanscom AFB MA 01730 (617) 861-3606
Air Force Rocket Propulsion Laboratory	43.6	Ms Chris Rosemarie Degnan AFRPL/TSPR Edwards AFB CA 93523 (805) 277-5677
Air Force Aerospace Medical Research Laboratory	18.7	Mrs. Joan Robinette AFAMRL/STINFO Wright-Patterson AFB OH 45433 (513) 255-3601

Atch 1

LABORATORY	FY 81 ANNUAL BUDGET ($M)	ORTA FOCAL POINT
United States Air Force School of Aerospace Medicine	26.2	Mrs. Eunice B. Garverick USAFSAM/TSK-2 Brooks AFB TX 78235 (512) 536-3321
Air Force Human Resources Laboratory	26.0	Mrs. Nancy Perrigo AFHRL/TSZ Brooks AFB TX 78235 (512) 536-3878
Air Force Armament Laboratory	61.2	Ms Sandra M. Lefstad AFATL/DLOD Eglin AFB FL 32542 (904) 822-5344/4740
Air Force Weapons Laboratory	152.3	Ms Margaret Putnam AFWL/SUR Kirtland AFB NM 87117 (505) 844-4293
Air Force Engineering and Services Center Research and Development	13.3	Capt Norman Fleming HQ AFESC/RDXX Tyndall AFB FL 32401 (904) 283-6493
Rome Air Development Center	281.5	Maj Virginia O'Grodnick RADC/TI Griffiss AFB NY 13441 (315) 330-2817/2628
TOTAL	1,361.2	

OFFICE OF THE UNDER SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

RESEARCH AND
ENGINEERING

AUG 12 A.M.

10 AUG 1981

Honorable Doug Walgren
Chairman, Subcommittee on Science,
  Research and Technology
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Walgren:

This is in response to your letter of 23 July 1981.

As discussed with Dr. Tom Kramer of your staff, I will not duplicate the Military Services' answers on the Service specific questions, but rather address Mr. Watkins' questions from the perspective of the Office of the Secretary of Defense. Those questions and my responses are attached.

Our Science and Technology program within the Department of Defense, while designed in response to defense needs, represents a national asset which should be exploited to the greatest good. As we have in the past, we will continue to support the concept of transferring technology from Defense laboratories to other sectors of our society within our legal restraints and the requirements of national security.

Sincerely,

Elbert W Friday Jr

Elbert W. Friday, Jr.
Acting Director, Research
  and Technical Information

Attachments

Question 1: There seems to be quite a misconception among the agencies as to what Congress intended when it mandated technology transfer in Section 11. Technology transfer was defined, for purposes of the Act, as the four functions listed in Section 11 (c). These functions are:

1) Preparation of application assessments for R & D projects.
2) Provide and disseminate information.
3) Cooperate with CUFT and other tech transfer brokers to move technology from the labs to the user community.
4) Provide technical assistance to the public sector in adapting federally developed technology for practical use.

It is important to stress that "information dissemination" comprises only one-fourth of our definition of tech transfer. In fact, during the hearings from which the legislation was developed, we discovered that a number of labs and agencies were disseminating information, but very few were taking the other three steps.

Please provide for the record a breakdown of all the tech transfer activities you have cited as satisfying the requirements of the Act, and indicate into which of the four classifications each falls.

Answer: The Department of Defense acknowledges the four functional areas of technology transfer specified in Section 11. However, we do not agree with the implication that each of the four areas requires the application of one-fourth of the technology transfer resources.

Mr. Carlucci listed 14 separate DoD technology transfer activities in his 5 February 1981 letter to Congress waiving the specific personnel and funding requirements of Section 11. That listing is attached for reference. Although specific categorizations may be somewhat subjective, the following table identifies which function each of these 14 activities supports.

Activity	Function
1	2
2	2
3	1, 2, 3, 4
4	1, 2, 3, 4
5	1, 2, 3, 4
6	1, 2, 3, 4
7	1, 2, 3, 4
8	1, 2, 3, 4
9	3, 4
10	1, 2, 3, 4
11	1, 2, 3, 4
12	1, 2, 3, 4
13	3, 4
14	3, 4

DOD TECHNOLOGY TRANSFER ACTIVITIES

	Activity	$(M)/yr	Prof. MY
1.	Army Corps of Engineers (STINFO)	3.3	99[a]
2.	Defense Technical Information Center	14.5	84[b]
3.	Information Analysis Centers	8.0	19
4.	Navy Technical Information/Technology Transfer	1.0	6
5.	Army Technical Information/Technology Transfer	5.5	182[d]
6.	Air Force Technical Information/ Technology Transfer	8.0	70[d]
7.	DoD Lab. manpower for technology transfer and the Federal Laboratory Consortium	1.5[e]	18
8.	DoD Manufacturing Technology Program (3% of $151M)	4.5	6
9.	Patent licensing programs (3 Services)	0.3	1
10.	Government/Industry Data Exchange Program	1.9	32
11.	Tri-Services Industry Information Offices	0.6	incl. in 5 & 6
12.	Potential contractor agreements (Navy NICRAD 60/yr)	0.3	11
13.	Projects for State and local governments (gratis)	0.3	5
14.	Navy non-DoD funded technology transfer projects	N/A	220[c]
	TOTAL	49.7	742

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a. Scientific and Technical Information (STINFO) only.

b. 90 authorized.

c. Dollars and manpower for Army and Air Force non-DoD funded technology transfer projects unavailable at this time.

d. Includes Items 11 & 12.

e. The Federal Laboratory Consortium for Technology Transfer was started by a small group of DoD laboratories in 1971.

Enclosure (1)

Question 2: Many agencies have tended to cite as tech transfer "success stories" examples where technology found its way into the public and private sectors, but did not start out as direct tech transfer activities.

This Committee's report which accompanied the Act makes it very clear that this does not satisfy the tech transfer requiremets of the Act. Let me quote from Page 32 of the Report·

> "...(T)he overriding consideration in making a determination as to what should be categorized as technology transfer is that the activity so classified should be dedicated to technology transfer from the outset (emphasis added)."

Answer: Those activities which are listed in response to question one are all applicable under the definitions contained in the Stevenson-Wydler Act. DoD has had an active technology transfer program in the past and will continue to do so.

Question 3: What is your Department doing now to promote technology transfer that it wasn'd doing prior to enactment of the Stevenson-Wydler Innovation Act?

Answer: Each Military Service has been advised by the Office of the Secretary of Defense that although the specific staffing and funding requirements of PL 96-480 had been waived as permitted by law, the requirement for the formation of an Office of Research and Technology Applications (ORTA) in each Federal laboratory must be satisfied. The Services were asked to establish the necessary ORTAs. They are now doing so as indicated in their separate responses.

Mr. ERTEL. The committee will come to order.

The next witness is Dr. Eugene Stark, chairman of the Federal Laboratory Consortium for Technology Transfer. We welcome you. Your written testimony will be incorporated in the record, without objection.

[The biographical sketch of Dr. Stark follows:]

BIOGRAPHICAL SKETCH

Dr. Eugene E. Stark, Jr.

Chairman, Federal Laboratory Consortium for Technology Transfer

Professional Position: Industry Liaison Officer
Los Alamos National Laboratory
Los Alamos, New Mexico 87545
Tel. (505) 667-1230

Dr. Stark was born and raised in Miami, Florida. He was educated in the Department of Electrical Engineering at MIT, receiving the B.S. and M.S. degrees in 1969 and ScD in 1972. He held an NSF Graduate Fellowship, 1968-1971, and a Hertz Foundation Fellowship, 1971-72. He participated in a co-op program at IBM, with two summer assignments at the System Development Division and one six-month assignment to the Thomas J. Watson Research Laboratory.

He joined the Los Alamos National Laboratory in 1972 in the Laser Fusion Program. He participated in experimental and theoretical laser research and development and held Deputy Group Leader and Project Leader positions in that program.

During a two-year assignment to the Director's Office staff, 1974-76, he developed a technology transfer program for Los Alamos and has headed this effort ever since. When Los Alamos joined the Federal Laboratory Consortium, in 1975, he was the Laboratory Representative; he became Mid-Continent Regional Coordinator in 1977, and was elected Chairman in October, 1980.

His present responsibilities at Los Alamos include technology transfer; the development of institutional goals, and implementation of strategy for cooperation with industry and universities; fulfilling the functions of the Office of Research and Technology Applications mandated in PL96-480; and serving as Program Chairman for the Showcase for Technology conference.

TESTIMONY OF EUGENE STARK, JR., CHAIRMAN, FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER

Dr. **Stark**. It is an honor to appear before your committee today to discuss the activities of the Federal Laboratory Consortium regarding the Stevenson-Wydler Technology Innovation Act of 1980.

As I am sure you are aware from previous testimony, even prior to the passage of the Stevenson-Wydler Act, there were several individual laboratories and agencies such as the Agricultural Extension Service, the staff unit in technology transfer in the Forest Service, NASA, as well as individual laboratories from many different agencies in Government who were active and effective in technology transfer.

The basic raison d'etre of the Federal Laboratory Consortium is to assist these laboratories and the other laboratories to multiply their resources and their effect on the national economy through efficient networking of their capabilities throughout the country, and to provide efficient access for users to the Federal laboratories. In addition to this aggregation, the networking function we develop across laboratories and agencies fosters communication and cooperation among the laboratories and agencies and works to identify and alleviate barriers to technology transfer.

I would like to mention only very briefly two of the many examples of the effectiveness of the Federal Laboratory Consortium that are mentioned in my written remarks.

The New York City Police Department is midway through implementation of an automatic fuel-dispensing system for police vehicles. With a total hardware cost of three quarters of a million dollars, the estimated savings in personnel and administration is $1½ million per year. Quite an impressive payback. This innovation took place because of several key factors.

First of all, a full-time professional from the Federal laboratories was assigned as a technology agent to the New York City Police Department. Second, similar activities from of Oklahoma City were communicated to that technical agent through the networking of the Consortium and NSF's local government program. Finally, there was a strong positive attitude within the New York City Police Department toward efficiency and innovation.

This is a very interesting program because several other jurisdictions are very interested in adapting that technology, among them the State of New York which has recently—issued a request for bids for pilot programs, as well as the city of New Orleans and the State of Pennsylvania.

In addition, we are beginning contacts with the Federal Government—initial contacts within GSA to transfer this technology back into the Federal Government because there are strong potentials for cost savings there.

Another example is the transfer of mechanisms. Using a small amount of seed money, the concept of conferences for industry was developed as a regional demonstration program. The first of these conferences was held in Philadelphia in September 1979, and the second was held last month in Baltimore. Along the same lines, a technology transfer conference for State and local governments was held in March 1980, in Baltimore.

As a result of these experiences, Senator Schmitt suggested that the Federal Laboratory Consortium and its member laboratories and others cooperate to develop a Showcase for Technology to be held this October in Albuquerque.

Following the successful business opportunities conference in Baltimore last month, initial plans are under way for a business opportunities conference to be held in 1983 in Pennsylvania, probably in Harrisburg or the Hershey area. This is just in the preliminary stages. Mr. Jerry Bortman is taking the lead in that particular area.

Mr. **Ertel**. Who is that?

Dr. **Stark**. Jerry Bortman.

Mr. **Ertel**. I will certainly be happy to contact him.

Dr. **Stark**. I would like to turn to the specific responses of the Consortium to the Stevenson-Wydler Act.

The first response has been to undertake comprehensive identification and examination of the issues and the implementation of the section 11 part of the act. In our semiannual meeting last October, we undertook intensive workshops to identify and examine issues as a result of that meeting and a report was issued. Several task forces were formed to examine those issues, including legal issues, the issue of how to best and most efficiently prepare applications assessments, electronic conferencing and communications, State and local governments as users, industry as a user, personnel-related issues in the technology transfer positions of Federal employees, and development of a list of Federal laboratories.

The second initiative we took was to provide information services to the various Federal laboratories and agencies on section 11. In particular, we prepared a videotape based primarily on interviews with Representatives Brown and Watkins and Senator Schmitt. Personal contact with the agencies in some laboratories has been undertaken. Very soon, I will be sending letters to the many Federal laboratories that are not now members of the Federal Laboratory Consortium, both to offer assistance to them in setting up technology transfer functions and in understanding what technology transfer is all about, as well as inviting them to join the FLC. We have also completed an organizational planning process to take advantage of this opportunity to strengthen the FLC in order to make effective use of the additional resources and commitment from the agencies and laboratories.

Finally, we determined to consolidate and build upon our past experience with private industry such as the demonstration program with the Santa Clara Chamber of Commerce in California, the business opportunity conferences that we have spoken about before, as well as the many experiences of individual laboratories in holding technology transfer conferences, workshops, and other mechanisms for working with the private sector.

We have begun to consolidate that experience by using the relationships with private industry as the central focus for our last semiannual meeting held in May in Dayton, Ohio.

We used an intensive workshop format to determine the issues and to brainstorm some action plans for working with the private sector. A report on the results of this meeting will be issued soon.

I would like to note that I had the pleasure of visiting the National Research Council of Canada 2 months ago on behalf of my laboratory to learn of the reasons behind their success in dealing over the past 10 years or so with private industry. They have a very active program. A few points, I think, are very relevant to these hearings.

The NRC staff in Canada feel that among the many reasons for their success, they would point out four that are appropriate to us at this point. One is the sincere, strong top-level support for cooperation with industry within the laboratories of the National Research Council of Canada. Secondly, the assignment of a dedicated full-time professional staff under the vice president for industry of the NRC of Canada. Thirdly, the view of technology transfer as a deliberate, managed process: Some technologies are so good that even if we try to hide them under a barrel, industry or State or local governments may hear about them and commercialize them very successfully.

The many other technologies that could be useful in the outside world may require a deliberate, managed process in order to succeed. More importantly, even those that have obvious potential for success will go more quickly, more smoothly, more efficiently in a managed process.

The fourth point was there ought to be a career-related incentive for the individual researcher to become involved in technology transfer projects.

I would like to close with two specific suggestions on strengthening the implementation of section 11.

First of all, we feel a very strong need for a supportive policy on active technology transfer within the federal agencies at all levels of management. That is, a policy that will be viewed by the laboratories by the individual researchers, by the management within the laboratories and the agencies, as true and genuine policy support in order to attract the right kinds of people and support to this activity.

Second, we feel strongly that within each major laboratory there should be a professional dedicated full time to active technology transfer and that this person be placed within the organization to allow good access to the technical staff as well as the respect and cooperation of that staff.

In summarizing, we feel that section 11 of the Stevenson-Wydler Act has provided an important opportunity for the Federal laboratories to multiply manyfold their contributions to this nation. The FLC is agressively attempting to assist the laboratories and agencies in this effort. We welcome the challenge that has been provided to us and with the true commitment and effort by the laboratories, we will make it work.

That concludes my remarks.

[The prepared statement of Dr. Stark follows:]

REMARKS
before the
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY

July 16, 1981

Dr. Eugene E. Stark, Jr., Chairman
Federal Laboratory Consortium

The Activities of the Federal Laboratory Consortium in Aiding the Implementation of PL 96-480

Mr. Chairman and Members of the Subcommittee:

It is an honor to appear before you representing the Federal Laboratory Consortium for Technology Transfer, to discuss the Stevenson-Wydler Technology Innovation Act of 1980.

I would like to address today the activities of the Consortium in response, specifically, to Section 11, The Utilization of Federal Technology, in furthering the domestic transfer of Federal technology, and to offer suggestions for realizing the full potential benefit of that section to the Nation.

THE FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER (FLC)

The FLC and its goals and objectives have been described in earlier hearings[1] so I will present only a summary here. Over 200 Federal Laboratories and R&D Centers from 11 Agencies are members of the Consortium. The National Science Foundation has been the sponsoring agency for ten years, and in recent years has provided seed-money support which has been crucial in solidifying the operations of the FLC and in undertaking demonstration projects which prove new mechanisms for technology transfer.

The goal is to facilitate the effective use of Federal technology and expertise in addressing domestic needs in the public and private sectors by providing the environment, the operational structure, and the necessary transfer mechanisms.

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[1] "The Role of the Federal Laboratories in Domestic Technology Transfer," testimony by G. F. Linsteadt before this Subcommittee, June 12, 1979, page 24.

The objectives are:

- To assist Laboratories to extend their contributions and multiply their resources efficiently through effective networking of these resources and aggregation and definition of users' needs.
- To provide efficient access for users to the Federal Laboratories.
- To develop and transfer the techniques of technology transfer.
- To foster communications and cooperation among the Laboratories and Agencies.
- To identify and work to alleviate barriers to technology transfer.

Although individual Laboratories and Agencies have proven to be highly effective in technology transfer, the role of the FLC is to extend this process to a much larger group of users from a larger resource of Laboratories through these key elements of networking, communications, aggregation, and methods development. The FLC has a user-oriented advisory committee, comprising representatives from industry, state and local governments, and universities.

The value of the FLC is indicated in the following examples, many preceding the passage of PL 96-480:

Emergency Vehicle Protection From Mount St. Helens' Ash

Following the May 18, 1980, eruption of Mount St. Helens, scores of emergency vehicles were totally disabled by the highly abrasive ash entering the engines. A request from the State of Washington to

DOT's Transportation Systems Center was referred to the Army Tank-Automotive R&D Command (TARADCOM). Five TARADCOM employees were sent to Washington and, before the second eruption on May 25, had designed, built and installed prototype air filtration systems on some patrol vehicles. The TARADCOM team worked with the Federal Emergency Management Administration during its two-week stay, providing advice to the public and all levels of government. This venture was successful in that the retrofitted vehicles functioned during subsequent eruptions. The networking function of the FLC was the key to this success.

Automatic Fuel Dispensing System For New York Police Department

Today, New York City is midway in implementation of an automatic fuel dispensing system for police vehicles. With a total hardware cost of 750 thousand dollars, the estimated savings in personnel and administration are 1.5 million dollars per year.

This project occurred because of several key factors:

- The assignment of a full-time professional from the Naval Underwater Systems Center to the Department under an Intergovernmental Personnel Act assignment.
- The appropriate communication of results of a similar project in Oklahoma City, through NSF's local government program.
- The positive attitude of the NYCPD toward efficiency, cost-cutting and innovation.

An interesting aspect of this project is its potential transfer to the Federal Government (e.g. GSA). The technical aspects of this project are being documented carefully for use by other jurisdictions;

New Orleans and the States of New York and Pennsylvania have already expressed strong interest in this technology.

Light-Weight Body Armor

Scores of law-enforcement officers' lives have been saved by light-weight body armor. These protective garments were developed by the Army Natick R&D Command and the Edgewood Arsenal for Department of Defense needs. Although the pressing need for better protection for policemen would have led eventually to the transfer of this technology, it was the encouragement of the FLC that convinced the Army labs to push this technology into industry. The result is more lives saved, earlier entry into the marketplace, and approximately thirty companies manufacturing various garments based on this technology. The FLC has also provided assistance to numerous jurisdictions in preparing specifications for purchase of these garments.

Technical Assistance To Beaverton, Oregon

Necessary maintenance (painting) of the city's reservoir cover had to be suspended when the residents complained of a foul odor in their drinking water. The city sought help first from the appropriate state agency, then from a private testing Lab. Because neither could help, the city contacted the NSF-supported Pacific Northwest Innovation Group, which brokered the problem to the Lawrence Livermore National Laboratory. After testing the paint and a sample of the reservoir cover, a procedure was recommended for applying the paint which avoided the odor problem. The city saved considerable money and the citizens were spared the foul odor with a small investment in time of Livermore scientists.

Technology Transfer Conferences

As a Regional Demonstration Project of the FLC, the concept of a Technology and Business Opportunities Conference (TBOC) for industry was developed, with emphasis on how to do business with the government, and on the technology transfer and technical assistance programs of the Laboratories and the FLC. Two TBOC's have been held, one in Philadelphia in September, 1979, and one in Baltimore on June 24, 1981. Both were very successful, due in large part to the cooperation of Federal Laboratories from several Agencies.

In March, 1980, Senator Mathias and the FLC sponsored a technology transfer conference in Baltimore for state and local government officials.

The experience and success of these conferences has led to the Showcase for Technology to be held in Albuquerque on October 28-30, 1981, cosponsored by Senator Schmitt, the FLC, DOE-Albuquerque Operations Office, Sandia National Laboratories and the Los Alamos National Laboratory. The development and transfer of this mechanism by the FLC will thus lead to a major opening of Federal technology to industry in the Showcase.

OBSERVATIONS ON THE CANADIAN EXPERIENCE

I had the pleasure of visiting the National Research Council of Canada recently, on behalf of my Laboratory, to learn their lessons of longstanding cooperation with industry. Of many insights gained, there are some key factors in their success that are relevant to this hearing:

- Strong, sincere top-level support for cooperation with industry;
- The assignment of a dedicated full-time professional staff to help instigate and coordinate cooperation for the transfer of NRC technology to commercial applications.

- For the highest probability of success, technology transfer must be a deliberate, managed process; there follow not only successful transfers but also two-way transfers.
- The process works best if there is a career-related incentive for the individual researcher to become involved in a technology transfer project.

RESPONSE TO THE STEVENSON-WYDLER ACT

The October, 1980, Semi-Annual meeting of the FLC was dedicated to a comprehensive examination of Section 11 of the Act. Issues, concerns, barriers and action alternatives were developed in 2 1/2 days of intense discussions. The Congressional intent was addressed by key Congressional staff. The major results of this meeting were a decision by the FLC to offer assistance to the Laboratories and Agencies in planning and executing their implementation of Section 11; and the formation of task forces to address the important issues: e.g., legal issues in technical assistance; preparation of the application assessments required in the Stevenson-Wydler Act; electronic conferencing and communications; state and local governments as users; industry as a user; personnel-related issues in the technology transfer positions of Federal employees; and development of a list of Federal Laboratories.

In addition, as an information service to the Laboratories and Agencies, a videotape presentation on the background and intent of the Stevenson-Wydler Act was prepared, using interviews with Rep. George Brown, Rep. Wes Watkins and Sen. "Jack" Schmitt.

At the May, 1981, FLC meeting, detailed discussions and directions for action were developed for cooperation of the FLC with industry. This was accomplished by inviting panelists from various sectors and sizes of technology-based industry to speak. Following their presentations, a series of structured workshops was held, with the industry panelists participating, to identify issues and to suggest action items. A report on the results of this meeting will be issued soon.

SUGGESTIONS ON IMPLEMENTATION OF SECTION 11

Although many issues have been identified and are being examined, the two key needs I would like to stress before this Subcommittee are:

- The need for a truly supportive policy on active technology transfer within each Agency from all levels of management, to attract highly qualified professionals and ensure full cooperation in their activities;
- The need for a professional dedicated full-time to active technology transfer in each major Laboratory, with an organizational placement conducive to obtaining the respect, cooperation and access to the technical staff.

Mr. ERTEL. Thank you very much, Dr. Stark. I have got to say first and initially, I'm interested in technology transfer. I have got some of the same interests Mr. Watkins has. You have been here over the last three days of hearings and you have heard everything.

Dr. STARK. Yes.

Mr. ERTEL. I would be very interested in seeing this in Pennsylvania which to some degree has some of the depressed conditions that Mr. Watkins has talked about. The area you are going into, however, is one of the bright spots of my district. Most of it is heavily industrialized and doing very well. I would like to see that that conference does take place. We will be in touch with you to try to assist you and also encourage you.

Dr. STARK. We look forward to that.

Mr. ERTEL. Let me ask you, since you have been here this entire time, how about summarizing your impression of the hearings so far, as far as what you have heard.

Dr. STARK. That is a broad question. I must say, first of all, these are the first congressional hearings I have ever attended, so it has been quite an educational process for me. I felt very positively about many of the things that I have heard during the hearings. We have seen very strong support for the concept of technology transfer from the Federal laboratories from the standpoint of certain representatives of industry as well as Mr. Sallot from the Society of Manufacturing Engineers. I feel that we are stepping out on a real challenge. We have been able to do quite a bit in the past based on ad hoc efforts and the individual commitments and foresight of individuals within laboratories as well as individuals within State and local governments and industry who after all took a bit of a chance in working with Federal laboratories, knowing that those laboratories didn't necessarily have a very strong mandate from their agencies or from the Congress to perform technology transfer activities.

I feel generally pleased with the attitudes of the agencies. What I think is most important is to see that policies are under development and, as shown by these hearings, the Congress is clearly interested in what the agencies are doing. We are hoping very much to see a strong policy commitment toward active technology transfer from all the agencies and look forward to having individuals from within the Office of Research and Technology Applications to work with.

I see a strong thread running through what the industry people and agency people have said. I guess my attitude—of all the people I have heard, I think it falls closest to that of Mr. Sallot, who said, "Let's make it work. It may not be perfect, but we would rather have 100 percent of something that is not perfect than zero percent of something that is to be determined in the future as being the perfect approach."

Mr. ERTEL. The NSF is going to eliminate its financial support for the Federal Laboratory Consortium. What will happen?

Dr. STARK. The Federal Laboratory Consortium actually began life within the National Science Foundation without any direct financial support from the foundation. That support has been about $435,000, cumulative over just the past 5 years. We found that support to be very, very important in developing and transferring mechanisms of technology transfer so that the burden of performing activities on behalf of all Federal laboratories does not have to fall necessarily on the shoulders of an individual laboratory.

In taking the lead in this particular area. I think in the short term, our networking function would certainly continue. In the long term, the development of the technology transfer process itself would be hurt badly.

For example, the conferences that we have talked about, for example, the business opportunities conferences, the first of those would never have gotten off the ground without the seed money support from the FLC to rent a hall and do publicity. I think the various conferences we have heard about from the first business opportunities conference in Philadelphia through the Showcase for Technology conference this fall and the one for 1983, none of those would have occurred without the seed money from NSF several years ago.

I think my fundamental feeling is the FLC will be there. Its effectiveness will be reduced significantly. I think more importantly without some seed money support, we simply could not grow to meet the full challenges of the Stevenson-Wydler Act.

So, it is a concern of ours.

Mr. ERTEL. What are you going to do?

Dr. STARK. Among other things, we would like to see whether individual laboratories or agencies will be willing to give some support for the operation of the Consortium. We have operated on a shoestring and that is fine with us. We would rather show effective activity from relatively low funding than find ourselves hit with a massive amount of funding and have to justify it. As Senator Schmitt said, there are some agencies that might have trouble justifying the appropriate expenditure of half a percent of their funds. But at present funding levels, we are hoping to find ways to raise that money perhaps from other Federal agencies.

Mr. **Ertel**. If you were the subcommittee, what would you do to implement the Stevenson-Wydler Act at this point? [Laughter.]

Dr. **Stark**. Not understanding the political process very well, I am not sure exactly what would be the appropriate role. I think if I were in a position of a benevolent autocrat who could simply tell people what to do——

Mr. **Ertel**. We are not in that position. [Laughter.]

Dr. **Stark**. I think continuous oversight of what the agencies and laboratories are doing in response to Stevenson-Wydler, a clear and continuing interest on your part in the new activities and the accomplishments under Stevenson-Wydler are the main things that we can look for. With the real interest within the subcommittee and by showing successes based on Stevenson-Wydler, we hope to multiply and expand those successes and develop even greater interest within the Congress, the administration and the agencies for the concept of technology transfer, I think that is the most one could ask for. If that were to happen, I think I would feel very good about the results.

Mr. **Ertel**. We have a secret weapon. We have Congressman Wes Watkins.

Mr. **Watkins**. I hope it is not too secret.

Mr. **Ertel**. I take that back. It is not secret. [Laughter.]

Mr. **Watkins**. I talked with Chairman Addabbo, and he basically expressed strong interest and support. He said if necessary, whatever language we needed to add to the congressional report or through the committee function, he's ready to cooperate and help.

I think that's the kind of oversight we may need down the line. I think the Federal Laboratory Consortium is a move in the right direction. I was really looking forward to it and I still think it has a tremendous role. We are going to keep pushing for that.

I applaud you for your efforts. I applaud all those who are cooperative in trying to make it work. I am a little bit critical of those who don't want to try to make it work. I think if we sit down and say, How can we make this thing work, as I mentioned earlier, and get as much of that 100 percent as we can, we will succeed.

Much of our technology transfer has been haphazard, hit-and-miss type situations in the past. We have tried to start synchronizing it. We may not have all the answers, but we can find different ways.

Do you agree with the statement that until such time agencywide policies are adopted, that technology transfer will continue to depend upon the individual efforts mostly of just certain motivated people?

Dr. **Stark**. I think that's basically correct. Clear supportive agency policies that are truly meaningful to the laboratories, the laboratory managers, project managers, line staff, and so on, are the key to making technology transfer work.

Mr. **Watkins**. Mr. Chairman, the problem I've got as I look at this thing is that we are really trying to work on the economy, and productivity, but we are eliminating a program that we are trying to help in that area. It looks like the administration is not making any effort. I don't think it will work completely that way.

Under the Stevenson-Wydler Act, out of that 0.5 percent, if we have got the right attitude, the different agencies could assist and support the Federal Laboratory Consortium effort with part of that money, if we come out with a general plan.

And also, the center for the utilization of Federal technology. If we consider this important, there is no reason why we can't sit down and look at it and say, Hey, this laboratory over here, EPA's agency, and this agency and all, could work together in a cooperative effort to try to make this thing work.

I think that's one thing where, even though they are saying, "Hey, we are going to cut that specific amount of money off," there is no reason why if we want to make sure there is a centralized operation we could not do this.

I applaud you and ask you for your continued dedication and efforts on behalf of trying to have Federal laboratories directly involved.

I want to apologize to the chairman and others that are appearing. I have got to make a speech in 4 minutes before a group, and I have had a longtime commitment on that.

Mr. **Ertel**. We appreciate your input and your interest, Congressman Watkins. You have been instrumental in moving the technology transfer provisions of this act and we appreciate your coming here. We look forward to cooperating with you, especially since you're on the Appropriations Committee and you have the money. [Laughter.]

Do you have a question, Mr. Rheem?

Mr. **Rheem**. You mentioned in your written statement one of the programs in technical assistance in involving an innovation group. I wonder if you could comment on how effective you feel those regional innovation groups have been?

Dr. **Stark**. The Consortium is by no means their primary technical source. We feel that groups such as the innovation groups are very, very important for effective and efficient utilization of Federal laboratory expertise.

If we in the laboratories had to in all cases deal individually with individuals from every city government, every State government, and every private company in the country, we might well be overwhelmed, and find our efficiency lost very quickly.

The important role that those innovation groups play is to find the generic, the common problems from among their jurisdictions in general and to help network them to the appropriate source of technology, rather than having to go through perhaps a large chain of people who constantly make referrals, which not only slow down the process, but take up quite a bit of time of the people in the middle.

My own experience with the innovation groups is that they have been aggressive in serving their clients and we feel they have made very effective use of the Federal Laboratory Consortium as a resource, in the sense that they have used us when it's appropriate and have contacted us and worked through us in an appropriate manner.

Mr. **Rheem**. Are there other mechanisms that you know of where groups represent municipalities and interface with you?

Dr. **Stark**. There are many such user groups. I should have mentioned that earlier. The U.S. Conference of Mayors has been very active in working with the consortium. Their pilot project was mentioned a bit earlier. They have some other projects underway to link several laboratories with cities that have the mayoral form of government.

The National Association of Counties is another user-group through which we have worked. There are many others, the National Conference of State Legislatures being one, and given time, I could come up with many others such as the Society of Manufacturing Engineers, as Mr. Sallot mentioned day before yesterday.

Mr. **Rheem**. Thank you.

Mr. **Ertel**. Thank you very much for your testimony and being with us today.

Our next witness is Mr. Richard Eckfield, chairman of the Technology Transfer Society task force on the implementation of the Stevenson-Wydler Act. We welcome you. Your written testimony will be incorporated in the record. You may proceed as you see fit.

TESTIMONY OF RICHARD ECKFIELD, CHAIRMAN, TECHNOLOGY TRANSFER SOCIETY TASK FORCE ON IMPLEMENTATION OF THE STEVENSON-WYDLER ACT

Mr. **Eckfield**. If it's possible to dispense with the reading of my statement and simply file it, I would like to do that very much.

However, I am obliged to say that the Technology Transfer Society on behalf of whom I am appearing today is a national nonprofit association of professionals from industry, government, and academia interested in technology transfer.

We are the only such organization existing in the country. We have been in business actively since 1975. We have annual publications and we have annual meetings.

On behalf of that group, let me officially thank the committee for its leadership in developing the Stevenson-Wydler Act and in section 11 in particular. I will dispense with the reading of the statement.

However, I would like to make a couple of points that I'm sure already have come to the attention of the committee. The first is the record of technology transfer in terms of getting a return on what we calculate to be almost the $200 billion investment in the last decade in R. & D. is poor. The second point is that this investment has the growth-shaping impact, particularly for some industries.

You are familiar with the statistics regarding the job creation of small industries. We have a number of sections in the testimony that deal with those points. I would also like to reference the fact that prior to Stevenson-Wydler and section 11, there were a series of small programs, pilot programs if you will, in various Federal agencies that have been successful. They have proven to be successful in terms of taking existing federally funded technology and making it available and having it applied. There is a recent GAO report of this month that I would like to call to the committee's attention. For the sake of time, I think it's best to simply concentrate on our concerns.

My colleagues who have been monitoring the hearings tell me that one of the questions the committee keeps wondering is, is this—section 11 of Stevenson-Wydler—really going to bring about a new beginning in technology sharing?

Our best estimate is no, not without some very assertive oversight and prodding on your part. I think we see in the waiver situation a number of inclinations to just simply do business as usual again. In the testimony you will find recitations of some of our concerns, concerns that primarily go to the fact that a lot of agencies have been doing business as usual.

I was going to tell the story of the past director of NSF, Mr. Atkinson, who firmly believed that if only you would research an issue the fact that you developed a technique would compel its being used.

That's not true. There is adequate study on dissemination theory and dissemination practice that shows that that's not the case. Direct technical assistance is required. That is, of course, one of the important four functions, that of technical assistance, which is mandated by, I believe, section (c) of section 11, subsection (c). It is critical.

Being conscious of the time and the desire to be able to present the views of the society, let me just simply cite four recommendations because you asked what the committee could do. One, of course, is to encourage, as we have stated on page 7 of our testimony, the agencies to prepare and disseminate the appropriate directives.

In questioning my predecessor, Mr. Stark, the question was, would they do it without that. We think not. So, it is going to take some amount of prodding on behalf of the administration and on behalf of the committee to get deliberate directives, because without those, I do not believe much will happen.

The second is to initiate appropriate funding for both CUFT and the Federal Laboratory Consortium. We find it inconsistent to entertain the notion that Commerce or NSF would request a waiver from the Stevenson-Wydler bill and at the same time not provide adequate funding for CUFT at the Department of Commerce and Federal Laboratory Consortium at NSF.

I am impressed by what apparently was the swiftness of Congressman Watkins in taking a defense issue to the Defense Appropriations Committee. It is perhaps appropriate for this committee to recommend to another—you know best how those procedures work—appropriate language particularly as it relates to these two vital organizations—Commerce and NSF.

The Center for Utilization of Technology was not just a figment of the imagination of the Assistant Secretary for Science and Technology. It was well thought out. It has a legitimate role and that role is needed. I think this committee can do a tremendous amount through the Commerce Department's appropriations process and other processes. The same is true with the FLC which is housed at NSF.

The third area of recommendation, again on page 7, is that special attention be given to making sure that particularly the larger laboratories, the laboratories with $20 million budgets, have dedicated personnel. You can talk about policy directives which makes things policy, but until you get to the actual dedicated people who are devoted to this function, I doubt very much that much will come of it.

I believe it is essential that you have full-time assigned, declared personnel working on the implementation of this act and these functions at the local level.

The fourth item that the committee might choose to consider is to in essence take a page from your colleagues who established the new superfund, which is the fund, you recall, for cleaning up the trash heaps and the chemical waste dumps, et cetera.

I believe that committee concluded that this was an issue that required sort of constant oversight and they in essence commissioned on an ad hoc basis a review group of practitioners who constantly served as a feed source for information to the committee.

We believe that the issues that are being dealt with in the Stevenson-Wydler Act and in section 11 in particular, are of such significant importance not only in terms of the potential for a return on investment of the $200 billion that's been invested in Federal R. & D., but also the impact that that could have on economy, that this issue might in fact warrant the committee to take such action.

I will spare you all the stories I had prepared regarding the fact that this gets to the heart of the issue of competition in foreign markets. The committee has had witnesses at other hearings talk about United States versus Japan, incorporated, and everything else.

But the fact of the matter is that this small section of this act might in fact be a key, not to be overly rhetorical about it, but the key that can in fact open a lot of doors in terms of U.S. efficiency, both in the private sector and on the State and local government side. Thank you.

[The prepared statement of Mr. Eckfield follows:]

TESTIMONY

OF

RICHARD E. ECKFIELD,

CHAIRMAN, SPECIAL POLICY COMMITTEE FOR
IMPLEMENTATION OF P.L. 96-480, OF THE
TECHNOLOGY TRANSFER SOCIETY

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH & TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY,
UNITED STATES HOUSE OF REPRESENTATIVES

JULY 16, 1981

Mr. Chairman, I am Richard Eckfield and I am here this morning to represent the Technology Transfer Society, a national non-profit organization of professionals from industry, government, and academia who are active practitioners in the area of technology transfer. The Society was founded in 1975 as a cross-discipline and cross-industry organization to serve as a catalyst for accelerating the movement of technology to ultimate application . Since 1975 we have published the Journal of Technology Transfer, the only such journal in this country devoted solely to that topic. Our diverse membership is concerned mainly with issues of technology transfer, utilization, assessment, and commercialization. I appear before you today as chairman of the Society's Special Policy Committee for Implementation of P.L. 96-480, the Stevenson/Wydler Technology Innovation Act of 1980. As a professional, I am also Administrator of the U.S. Conference of Mayors Research and Educational Foundation, a non-profit research foundation interested in the use of science and technology to improve local government's ability to deliver basic services. We also conduct research on ways in which cities can encourage new business development and activity through the active transfer of federal technology.

Commendation of Committee and Background of Formation of T^2S - Society Policy Committee

Before I proceed, Mr. Chairman, the Technology Transfer Society would like to commend the work of this Subcommittee during enactment of the Stevenson/Wydler Technology Innovation Act. We especially want to thank you and the Committee for the pioneering efforts that led to the inclusion of Section 11. I will limit my remarks to this section of the law.

The importance of new high technology companies which result from technology transfer to this country's economic well-being cannot be minimized. Statistics show that for the period 1967-1975 such companies averaged a 42.5% annual growth in sales and 40.7% annual growth in jobs versus large mature companies which have shown an 11.4% increase in sales and a 0.6% increase in jobs. 1/ Thus the major source of new jobs for the economy in the recent past has been new high technology firms. This trend will be extended to the immediate future. Recent studies, both here and abroad, indicate that the major growth in jobs and GNP over the next twenty years will be generated in fields resulting from technological innovations related to electronics, energy, health and aeronautics and space. These innovations will:

1. create new markets.
2. replace existing products with improved ones.
3. add new functions to existing markets and expand those markets.
4. expand related fields, such as parts and raw materials.
5. expand peripheral equipment and service industries.

They will not only create new jobs but will increase productivity, both in the public and the private sector and for both large and small businesses.

To achieve this purpose and to maintain our role not only as the preeminent developer of technological innovations but also as a competitive producer of goods and services, the U.S. must make effective use of the vast amount of research and development already paid for by the federal government and available from its laboratories. A high rate of return on investment to the taxpayers for the over $200 billion already spent on R&D over the last decade must be a priority of any program of economic growth. Such a policy will help to:

1/ Department of Commerce, Technical Advisory Board Annual Report, 1975.

- create new jobs.
- expand our domestic economy in the form of long term growth.
- regain our competitive position in world markets through increased productivity and innovation.

The critical element is to move the technologies from government to the private sector to accomplish these goals.

The enactment of the Stevenson/Wydler Technology Innovation Act, and especially of Section 11 regarding the utilization of federal technology, is a major step in the accomplishment of this goal of effective use of federally-funded technological innovation. When combined with such other needs as more effective tax incentives for high technology businesses and the removal of regulatory obstacles to the transmittal of technology (as in P.L. 96-517 passed in December which set uniform patent rights for inventions arising from federally supported R&D), Section 11 can lead to a major improvement in the effective commercialization of such breakthroughs in technology. Thus Section 11, if implemented successfully, will lead to the formation of new business activity, new jobs, and a revitalization of our innovative capabilities.

The benefits, however, are not restricted to the private sector. State and local governments also will benefit directly from the application of technology, to help solve pressing problems which they face. The net result is increased efficiency, and productivity in both the public and private sectors, and an overall greater return from our Federal R & D investment.

Positive Signs

Mr. Chairman, I would like to mention briefly some examples of Federal programs which are already capitalizing on the tools provided by Section 11 and are successfully commercializing Federally developed technology.

These include:

- * The Technology Commercialization Program of the Minority Business Development Agency in the Department of Commerce.
- * The Technology Transfer Program of the Federal Laboratory Consortium at the National Science Foundation, including the work of a number of federal laboratories.
- * The Small Business Innovative Research Program at the National Science Foundation.
- * The Energy-Related Inventions Program at the Department of Energy.
- * The Small Business Advanced Technology Program at the Department of Defense.
- * The City/Federal Lab Partnership Program being conducted by the U.S. Conference of Mayors in cooperation with the Federal Laboratory Consortium.

The success of a number of those programs has been confirmed by a recent GAO report,[2/] which offers clear evidence that the necessary institutional mechanisms exist. These mechanisms work, and there is growing evidence that the potential users, both public and private, are ready, willing and able to tap into this resource.

2/ GAO report PAD-81-15 dated July 7, 1981, Consistent Criteria are Needed to Assess Small Business Innovation.

Concerns:

Despite these positive signs, Mr. Chairman, we have a variety of concerns which result from our observations to date. I will mention five of these briefly.

1. Definition of Technology Transfer

We are concerned that many agencies seem to have misunderstood what is meant by technology transfer. As that term is used in this law it refers to the four specific functions specified in Section 11 (c). Compliance with the law requires that every laboratory perform at least these four functions. Technical information services and library type activity is not enough. Application assessments of ongoing R&D, technical assistance, and cooperation with CUFT and other technology transfer organizations also are necessary ingredients in achieving an effective technology transfer program.

2. Support for CUFT and the FLC

We also are concerned that the Center for Utilization of Federal Technology (CUFT) within the Department of Commerce, and the Federal Laboratory Consortium (FLC) have not been given the necessary support to carry out their responsibilities under the law. Their roles are critical. Effective transfer of technology requires that a central clearinghouse exist and that a single point of entry be established as was envisioned in the establishment of CUFT. It is equally important that inter-laboratory and inter-agency communications and coordination as provided by the Federal Laboratory Consortium be maintained. This is the vital link which connects users directly to the source of technology.

3. Active, Dedicated Professionals Are Needed

Our third concern is that some agencies may feel that they are already meeting their technology transfer requirements through passive or serendipitous transfer of their mission-related technology into the public or private sector. Our experience as professional practitioners indicates that such inaction is not sufficient. Active outreach is required. Dedicated, full-time professionals are essential. Successful technology transfer requires that an agency take the initiative, as well as respond to requests from the user community.

4. Confusion about the Waiver Provision

It appears that the waiver provision may have confused some agencies as to their mandated responsibilities under Section 11. We are concerned that agency management may unwittingly interpret the waiver provision as a loophole--a way to avoid many of the required technology transfer functions--rather than as an instrument of flexibility as was intended. The language of the legislation clearly indicates that, if an agency head waives either the minimum staffing requirement or the minimum funding set-aside, he or she must "submit to the Congress...an explanation of the waiver and alternate plans for conducting the technology transfer function at the agency (emphasis added)." Obviously, the report must explain how the agency will carry out the four technology transfer functions required in Section 11 (c). By submitting a waiver, the agency is not relieved of the responsibility to carry out these four responsibilities; it is merely provided the flexibility to come up with an alternate plan for achieving these duties.

5. Concern About Fragmentation of Responsibility

We are concerned that the technology transfer mission will be a part-time or fragmented responsibility. Effective execution of Section 11 requires a full-time professional whose sole function is to carry out the four responsibilities mandated by Section 11 (c). Experience has also indicated that this function is best performed at the laboratory level, and should not be relegated to the headquarters level.

Recommendations

In light of these concerns, Mr. Chairman, we submit the following recommendations for your consideration:

1. Encourage each agency to prepare and disseminate at all appropriate agency and laboratory levels, definitive policy directives for the efficient implementation of Section 11.

2. Ensure that adequate funding and support be provided to CUFT and the FLC to carry out their specified responsibilities under Section 11. If necessary, portions of funds included in the 0.5% set-aside of Commerce, NSF and the other agencies should be devoted to CUFT and the FLC.

3. Special attention should be given to ensuring that, wherever possible, but certainly in all of the laboratories with annual budgets exceeding $20 million, at least one professional be assigned full-time to perform that laboratory's technology transfer functions. The need for a dedicated full-time person is the single most important consideration in achieving an effective technology transfer program.

4. Establish a mechanism (formal or informal) to ensure a continuing review with periodic reporting to the Congress over the next year on the status of implementation of Section 11. This might , for example, take the form of an Ad Hoc Advisory Committee comprised of users and professionals in the field of technology transfer.

Conclusion

Mr. Chairman, this law is important to the profession of technology transfer, and, more importantly, to the economic well-being of our nation. I want to thank you and the committee for inviting the Society to present its observations and recommendations before you this morning. Thank you very much.

Mr. **Ertel**. Thank you very much.

Just one brief question. We have heard people talking about the Showcase for Technology and other types of conferences. Have you participated in any of those? If you have or at least have been present, do you think they are effective?

Mr. **Eckfield**. Yes, they are. The problem is that they are anecdotal stories, which are great, and my favorites come from DOE labs, Lawrence Livermore, et cetera, where they solved stoplight problems by using microcircuitry and they solved contamination of water supplies in terms of tastes, because of the ability to diagnose chemical intrusions that the city and the consultants were not able to find because of the sophisticated technologies that they have.

The problems with all of those anecdotes is that they are just that, anecdotes. It is based on the strength of those anecdotes that I believe Mr. Watkins and members of this committee, your colleagues on the Senate side also, saw enough there that they wanted to legitimize that.

The problem is that in legitimizing it, it requires a change in role. If I were to repeat anything, it would be that we find little evidence that the spirit of Stevenson-Wydler, if you will, is percolating through the Federal agencies.

That could be a product of the fact that it's a new law and they haven't switched over. It could be a product of the fact that there are tight budgets and people have their minds on other things.

But unless there is some degree of continued vigilance, somehow, through an oversight group or whatever, the anecdotes will probably continue, but they will probably continue as just that, isolated, one or two at a time.

In my testimony, and my predecessor also mentioned a project we have run. We are very happy with it. We tried to match up 10 cities with a group of laboratories so they could work together.

That's great. That's only 10. It's better than zero, but it's only 10.

Mr. **Ertel**. You have talked about continuing the review over this act. Are you volunteering to do the technology transfer study for the committee.

Mr. **Eckfield**. We would be delighted to participate in that in any way possible. We would be happy to respond affirmatively to any request you would like to give us in that regard.

Mr. **Ertel**. I am pleased. We will probably be taking you up on that offer.

If there are no further questions at this point, I think we will stand in adjournment until the call of the Chair.

[Whereupon, at 12:26 p.m., the hearing was adjourned, subject to the call of the Chair.]

APPENDIX I

Additional Statements for the Record

FMC Corporation

Marine and Rail Equipment Division
4700 Northwest Front Avenue
Box 3616
Portland Oregon 97208
(503) 228 9281 Telex 36 0672

FMC

September 22, 1981

The Honorable Doug Walgren
Suite 2321
Rayburn House Office Building
U. S. House of Representatives
Washington, D.C. 20515

Dear Congressman Walgren:

This is in response to your September 3, 1981 letter regarding implementation of the Stevenson-Wydler Technology Innovation Act of 1980.

Late last year I was briefed on the Department of Commerce's plans to develop a center for generic technology in welding and joining. As was my opinion then, I believe such a center is needed, assuming it would provide American industry with research and technology not previously available and not being provided elsewhere.

I regret I do not feel qualified to comment on the need for cooperative generic technology centers in general. The major manufacturing activity in the operation I manage is welding, so I am perhaps more knowledgeable in that technology than other fields.

Please contact me again if I can provide you with further information.

Very truly yours,

John Carroll

John E. Carroll, Jr.
Division President

blw

UNITED STATES CONFERENCE OF MAYORS
1620 EYE STREET, NORTHWEST
WASHINGTON, D.C. 20006
TELEPHONE: (202) 293-7330

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Mayor of Lincoln
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Mayor of Oak Park, Mich.
DAVID T. SHIFFMAN
Mayor of Santa Barbara
GEORGE V. VOINOVICH
Mayor of Cleveland
DANIEL K. WHITEHURST
Mayor of Fresno
PETE WILSON
Mayor of San Diego
Executive Director:
JOHN J. GUNTHER

July 22, 1981

The Honorable Doug Walgren
Chairman
Subcommittee on Science,
Research and Technology
2319 RHOB
Washington, D. C. 20515

Dear Mr. Chairman:

On behalf of the U. S. Conference of Mayors I would like to thank you and your committee for its special interest in the Stevenson/Wydler Technology Act, especially Section 11. As Chairman of the Conference's Subcommittee on Science and Technology, let me reaffirm our strong support for expeditious implementation of the Act. Clearly your recent oversight hearings were a critical first step in conveying to federal agencies that it is in the national interest to develop action-oriented technology transfer programs.

I am enclosing for the Committee's record a policy resolution unanimously adopted at our 49th Annual Conference in Louisville, Ky. This resolution calls for all agencies to implement Section 11 as soon as possible. In order to assist this process the Conference has also begun its own demonstration program, called the City/Laboratory Partnership Program. Ten cities throughout the country have already begun to develop local working groups with federal Laboratory officials to start implementation of Section 11. Enclosed is a description of this program and recommendations to the committee regarding implementation of Section 11 of the Act.

I want to thank you again for the committee's work on enacting P.L.96-480 and for your continued oversight interest.

Sincerely,

William E. Hanna, Jr.

William E. Hanna, Jr.
Mayor, Rockville, MD
Chairman, Subcommittee on
Science and Technology

Enclosure

UNITED STATES CONFERENCE OF MAYORS
1620 EYE STREET, NORTHWEST
WASHINGTON, D.C. 20006
TELEPHONE: (202) 293-7330

SCIENCE AND TECHNOLOGY

Resolution Adopted Unanimously
at the 49th Annual Conference of Mayors

Louisville, Kentucky

June, 1981

WHEREAS the Stevenson/Wydler Technology Innovation Act of 1980 represents the first Congressional mandate requiring 800 federal laboratories to offer technical assistance to cities; and

WHEREAS Section 11 of the Act also requires that every Agency set aside .5% of all research and development funds to assist federal laboratories in their efforts to transfer federal technology to the public and private sectors; and

WHEREAS the Conference of Mayors is currently initiating a pro gram in cooperation with the Federal Laboratory Consortium to help cities establish working relations with local federal laboratories and to identify joint projects involving environmental protection, economic development, public works and other matters of public concern.

THEREFORE, BE IT RESOLVED that the U.S. Conference of Mayors urges the Administration to encourage agencies and federal laboratories to implement Section 11 of the Act expeditiously.

BE IT FURTHER RESOLVED that Congressional oversight hearings be held in the near future to monitor the progress of the Act's implementation among all relevant agencies; and

BE IT FURTHER RESOLVED that the National Science Foundation be encouraged to continue its support of the Federal Laboratory Consortium which will assist cities in their efforts to identify resources within all Federal Laboratories.

THE U. S. CONFERENCE OF MAYORS CITY/FEDERAL LABORATORY PROGRAM

The U. S. Conference of Mayors has initiated a special program that will allow cities and federal laboratories to begin implementation of Section 11 of the Stevenson/Wydler Technology Innovation Act. Section 11 requires that each federal laboratory establish an Office of Research and Technology Application (ORTA). Subsection c (4) mandates that these offices offer technical assistance to state and local governments in the area of technology transfer. As defined by the Committee's Report, technology transfer is the use of a particular process and method for transfering federal technology to both the public and private sectors. Under Section 11 of the Act, technology transfer is clearly defined as four functions, one of which is technical assistance to local governments.

In order to help assure the expeditious implementation of Section 11, especially 11 (c)(4), ten cities have expressed interest in immediately establishing formal working relations with federal laboratories within their geographic vicinity. This "bottoms-up" approach is an indication that the public sector thinks tremendous benefits can be gained through the development of active technology transfer programs.

The Conference of Mayors, with assistance from the Federal Laboratory Consortium, will assist each city in establishing formal working relations with one or more federal laboratories. A Local Working Group will be established comprised of city officials and laboratory personnel. Both the Mayor and the Federal Laboratory Director will serve as ex-officio members.

The Local Working Group will begin discussions relating to potential cooperative projects between the city and the federal laboratory. The identification of these special projects through a cooperative approach will result in long-term positive relations and will help in forming a true partnership between the lab and the cities, as clearly mandated in 11 (c)(4) of the Act.

In order to assist each city, the Conference will establish in the Fall a National Committee to assist these cities in whatever way possible. This committee will include prominent congressional representatives, private sector leaders, federal laboratory directors and Mayors. Its purpose will be to promote agency cooperation in the City/Federal Laboratory Partnership Program and to give guidance in the expansion of the program beyond the original ten sites.

Mr. Chairman, as we make progress in beginning this new program, I will be looking forward to keeping the Committee informed regarding the cooperation we anticipate from the agencies and laboratories.

RECOMMENDATIONS

Mr. Chairman, I would like to make four recommendations regarding implementation of the Act.

1) Technology transfer ought to be reviewed as an action-oriented program by the agencies and laboratories. Section 11 should, for the most part, foster new activities that indicate a willingness by the agencies

to take seriously Congressional intent of the Act. We think Section 11 gives these agencies a new mandate for establishing specific technology transfer processes and programs.

2) The Committee should require the U. S. Department of Commerce to fund the Center for the Utilization of Federal Technology (CUFT) at levels that will enable CUFT to perform those functions as outlined in Sec. 11 (d), especially (d)(4) which provides funding for special technology transfer projects between federal laboratories and local governments. Should DOC apply for a waiver of the .5% set-aside, the Conference encourages Congress not to accept this waiver unless CUFT is adequately funded, with priority given to those functions that will result in the direct stimulation of technology transfer projects between local governments and federal laboratories.

3) The Committee should also require the National Science Foundation to fund the Federal Laboratory Consortium (FLC) at appropriate levels. The Foundation's current budget eliminates the FLC, which fills a critical role as a technology transfer network among federal laboratories. Based on the FLC's superlative record and its specific reference in Section 11 of the Act, the Conference encourages Congress to relay to the Foundation that the FLC is considered an essential part of the Foundation's technology transfer mandate. If necessary, funding for the FLC should come from portions of the Foundation's set-aside, as referenced in Sec. 11 (b) "each Federal Agency...shall make available not less than 0.5 percent of the agency's research and development budget to support the technology transfer function at the agency and at its laboratories" (emphasis added).

4) The Conference encourages the Committee to establish a Special Advisory Group to assist the Committee in oversight activities regarding the Act.

Mr. Chairman, I want to thank you for this opportunity to relay to the Committee our recommendations and a description of our technology transfer activities. If we can be of any assistance in elaborating on these recommendations, we would be pleased to do so.

4769 Kandel Court
Annandale, Va. 22003
October 16, 1981

The Honorable Doug Walgren
House of Representatives
Wasington, D.C. 20515

Dear Mr. Walgren:

Reference your letter of September 3 requesting comments on the need for cooperative generic technology centers. In response, I am directing my comments specifically to the need for a

CENTER FOR THE WELDING OF METALS

I will illustrate the urgency of the need for such a center by citing specific examples of failures in welding technology that have occurred in the last decade and are continuing to occur. This is a problem of national scope that has needlessly cost the United States (U.S.) untold millions of dollars and sometimes lives.

SUMMARY STATEMENT

In August 1976, an Engineering Foundation Conference entitled "Welding Research and Development (R&D) - Problems and Oppotunities" was held at New England College, Henniker, New Hampshire. The American Welding Society (AWS) and the Welding Research Council (WRC) co-sponsored the conference

> "because of the growing realization that the welding research effort in the U.S. is declining, whereas in many industrialized countries - Russia, Japan, W. Germany - it is increasing.

One of the topics was "Is an American Welding Institute a Viable Option?" The speaker on this topic was Paul W. Ramsey, past national president of AWS; he suggested that in his view

> "a properly planned American Welding Institute could perform many functions that would supplement and enforce current activities in welding R&D, welding education, and training and evaluation of welding personnel.
>
> "In addition to the R&D work, research specialists would also provide educational and training services and generate income from these ancillary activities. Such cross-fertilization should help the research efforts and improve the educational and training efforts."

I fully endorse the idea of a Welding Institute. Many countries already have highly productive welding institutes, including our neighbor Canada and even many of the small Eastern European countries.

Without R&D, we will see increasing amounts of U.S. dollars spent overseas for new, better products, and with the present shortage of adequately trained welding engineers and welding metallurgists, our R&D effort is slow, inefficient, and sometimes ineffectual, not to mention the costly failures in welded construction.

Some would have us believe that Japan's highly competitive positon in industries heavily dependent on welded construction (e.g., ships and bridges) is simply a matter of government subsidization of industry, lower wages, and/or newer (post-WWII) facilities. In fact, a vigorous, highly effective program of welding R&D is a major factor in their success. And to achieve their R&D objectives, welding engineers and scientists (welding metallurgists) are available in sufficient number to staff their construction facilities and laboratories.

In the following paragraphs, I will present facts documenting a welding-related problem in the bridge-building industry — a problem that stems from:

(1) deficiencies in the design of welded connections,
(2) a shortage of qualified welding engineers,
(3) ineffective quality control and quality assurance involving poorly trained (or unmotivated) welding inspectors and non-destructive testing technicians,
(4) lip-service control of heat-to-heat variations in weldability,
(5) out-of-control weld repair and "cosmetic corrections,"
(6) poorly executed or non-existant low-hydrogen practice, and
(7) fabrication done either without welding-procedure specifications or without regard for "limitation of variables," of the AWS D1.1 Structural Welding Code (Section 5.5).

I have selected the bridge industry to illustrate the need for a "welding institute" because for approximately 9 years, I have served as Principal Welding Engineer, GS14-10, (most of the time the only welding engineer) in the Federal Highway Administration (FHWA). In this capacity, I have been in a unique position to observe and document the welding-related problems that exist in our Interstate Bridge System.

In the 1970s, at least 25 bridge girders suffered brittle fracture and over 100 girders were found to be cracked; fortunately, (providentially) there was no catastrophic collapse of a bridge. However, with an apparently increasing incidence of weld cracking and fatigue cracking, the probability of a catastrophic collapse occurring in the 1980s is very real indeed.

POPULAR VIEW OF WELDING

The shortage of welding engineers. Most people, including many administrators in our colleges and universities, see welding as a trade requiring skill but involving little or no engineering or science. This is a fallacy that may, in large part, have led to a shockingly few engineering schools awarding BS degrees in WELDING ENGINEERING or offering a major in welding engineering. In the USSR, for 2 decades, the Soviets have graduated an average of 2,000 solidly educated welding engineers (often involving a 5-year curriculum). In the same time interval, we have averaged about 20 BS Welding Engineers each year.

Following my visit to the USSR in 1971, (by personal invitation from the USSR Academy of Science, the U.S. Air Force, Foreign Technology Division, WPAFB, asked me to write a report describing the Soviet educational system and curriculum for welding engineers, and showing the price we are paying as a result of an acute shortge of welding engineers in this country. The latter topic was considered important to get the attention of educators and government administrators (see Enclosure A).

Dr. Hallock C. Campbell,AWS Manager, Education, having read my report, advised AWS headquarters (memo of June 4, 1974, to H. A. Fenton) as follows:

> "(The) report will make distressing reading for AWS members. His "white paper" is a telling comparison of Soviet accomplishments against American deficiencies in educating welding engineers. Hartbower well documents our basic need for welding engineers.
>
> "Hartbower maintains that we need 2,000 new welding engineers each year, the number being turned out by the USSR. He best documents this by reviewing 5 major innovations in welding which we notably failed to followup or make effective use of, and 5 major unfinished welding research problems posed in the 1968 Welding Research Supplement (some were originally listed in 1958, 1960, 1962, or 1965).
>
> "As epilogue, he quotes from his own prophetic trip report of 1961 which stressed our need to coordinate R&D effort and to strenuously increase materials research. He attributes our failure to use new processes and new welding information spelled out for us in foreign publications to our shortage of well-trained welding engineers. Few managers in our governement and industry understand the complexities of the welding process.
>
> "Amen. Let's spread the word."

But all who read my report (except Dr. Campbell) including other AWS headquarters personnel, found the report too distressing for publication. Only a highly abbreviated version of the "white paper" was ever published (Welding Design and Fabrication, August 1977, page 63 under the title "Reds Shut Out Yankees! Russians show the U.S. how to educate welding engineers").

Why the concern over a "shortage" of welding engineers in the U.S.? Without people in our educational institutions who understand the complexities of the welding process, the funding of research in universities can hardly be productive. The graduate students doing the welding research must be enrolled in a curriculum steeped in welding and metallurgy – often they are not. With only a few colleges and universities even having a major in welding engineering or welding metallurgy, much of the WRC funding of welding research in our universities has been relatively unproductive in terms of the development of new or even improved technology. Thus, there is a clear need for a COGENT program in the welding of metals where the center will have both graduate students and faculty (providing supervision and management) who are expert in welding engineering and/or welding metallurgy.

The need for welding engineers and a "welding institute" - myth or reality? A few decades ago ships, buildings, bridges, aircraft, etc. were mechanically fastened; today, just about every major structure or structural component involves welding or is completely joined by welding. When done properly, welding is highly cost effective, requires fewer pounds of metal (as compared to riveting or bolting), and provides joints as strong or stronger than the metal being joined. When welding is improperly done, the result is markedly increased cost, production delays and danger of structural failure. When failures in welded construction occur, most people in management see the problem as that of someone else. There is always someone else to blame - and often there is in fact more than one cause. Lack of motivation, lack of skills, lack of training - these are people problems. But often management is also a contributor by not providing adequate numbers of supervisors, and/or supervision without the necessary training and education to understand the complexities of welding technology. The latter is true not only in the fabrication shop but also in companies that design our structures. A welding engineer is rarely found on the staff of design consultants; thus, weld design is sometimes (if not often) generated where:

> the design does not take into account the optimum methods for achieving low-cost, high quality weld joints;
>
> the design requires too many welds (a labor-intensive operaton), and sometimes specifies welding in the wrong locations from the standpoint of accessibility or inspectibility,
>
> the design specifies material(s) for welded contruction without due regard for possible adverse effects of welding on the heat-affected zone; the properties of weld heat-affected zone are generally neglected as regards to their mechanical properties.

With relatively few welding engineers and metallurgical engineers in the U.S. who have majored in welding engineering, there is not only a problem in the production of defect-free structures but also a problem in accomplishing the R&D that is necessary for innovation.

With a CENTER FOR INDUSTRIAL TECHNOLOGY devoted solely to the welding of metals, particularly if patterned after the British WELDING INSTITUTE, there should be a new impetus for producing Bachelor of Science welding engineers in our colleges and universities, and in sufficient numbers to achieve much-needed cost-effective, higher-quality welded construction.

The promotion of welding technology as an important technological engineering challenge (and it must be seen as just that to attract educators and students) is an uphill task that has proven to be virtually impossible without a U.S. WELDING INSTITUTE. The Director General of the Canadian Welding Development Institute, Dr. Norman F. Eaton, described the situation nicely (Engineering Journal, March/April 1976):

> "Mention of the word 'welding' — even if qualified by 'technology' or even 'engineering' — conjures up in the minds of the general public, many engineers and certainly most scientists, an image of men clad like medieval warriors in dark headshields and leather smocks emitting flames or sparks in an environment which is usually cluttered, dirty, and immersed in fumes."

In fact, welding is an advanced technology involving metallurgy, mechanics, electronics and more.

Will our national R&D needs be met by industry on its own? It is my understanding that a management official from the U.S. Steel Corp. testified before your subcommittee, indicating that he saw no need for a Center for Welding Development, that the Corporation would do its own research.

A "Survey of Corporate R&D Spending: 1975" in the June 28th issue of Business Week, pp 62-84, showed that the steel industry has a very poor record in terms of R&D spending, and I doubt that the record will be much different in the 1980s. Moreover, in an examination of Corporation R&D spending, it is important to make a distinction between (1) R&D and (2) proprietary failure analysis and/or product development. The latter are likely to benefit few if any outside the corporation funding the work.

A series of related researches conducted by the U.S. Steel Corp. during the period from 1954 to 1964 (Applied Research Lab Projects 40.02-004(1) and 56.02-002(1), (2) and (3)) provide an example of how R&D dollars can be spent and yet be unproductive in terms of the National interest.

The research findings (above) were a hotly debated issue in a court trial in 1980 involving the U.S. Government (TVA) and the fabricator of welded components for a hydroelectric station (Raccoon Mountain):

> Tennessee Vally Authority and Allis-Chalmers
> Corporation v. Lukens Steel Company and United States
> Steel Corp. Civil Action Nos. 1-78-43 & 1-78-250.

The reports from the researches conducted from 1954 to 1964 were placed in evidence but at the request of U.S. Steel Corp. were treated as "CONFIDENTIAL PURSUANT TO COURT ORDER." The findings of the researches have been held by the U.S. Steel Corp. as confidential for over two decades. If the research findings had been known to the TVA contractor, it is possible that millions of dollars in unnecessary extra cost and long delays in the project could have been avoided.

CRACKING AND BRITTLE FRACTURE IN WELDED STEEL BRIDGES

Cracked and fractured welded plate girders. The incidence of brittle fractures and weld cracking in steel bridges has reached alarming proportions in the 1970's. Over 20 bridge girders have developed brittle fracture, and in-field inspections of bridges under traffic have revealed hundreds of rejectable indications using ultrasonic testing (UT). Millions of dollars have been spent in bolt-splice repair of defective butt welds in fracture-critical members. The Silver Memorial Bridge at Point Pleasant, West Virginia, the Paducah Bridge on I-24 between Kentucky and Illinois, and the Fremont Bridge in Portland, Oregon, are among the major bridges found to have UT-rejectable indications after they were being erected or in service. Intensive investigations are in progress to determine why and when the cracking occurred.

In just one State, inspection of 44 two-girder bridges with intermediate floorbeams and stringers revealed 24 bridges with cracked members. The cracks occurred near the top flange at the floorbeam-to-girder connection plates; the general problem is believed to be out-of-plane deformation in the girder webs caused by end moments in the floorbeams. In the 24 cracked bridges, there were 290 cracked locations in negative-moment areas.

One bridge, which in 1973-74 had been given "in-depth" inspecton in 1977 was found to contain 132 UT-rejectable indications of length 1/4-in. or greater in 51 flange groove-weld butt splices. The bridge was closed and over $1 million was required for repair. Another bridge contains a great number of fatigue cracks at the toe of fillet welds connecting cover plates to flanges. Some of the cracks were as long as 2 in. and over 1/2-in. deep. The recorded stresses were small (RMS stress range only about 1.3 ksi); a tremendous traffic count is said to explain the fatigue-crack growth. But there may be another problem which has not been adequately addressed - initiation of fatigue crack growth as a result of weld-toe cracking at the time of fabrication and undetected by quality control or quality assurance. Microcracking at weld toes intensifies the stress-concentration factor inherent in the toe geometry and is exceedingly difficult to detect in nondestructive inspection.

Why have there been twenty five or more brittle fractures in bridge girders in the 1970s and why has there been so much cracking in bridge girders in the 1970s? Why are so many cracks found after the bridges are erected and under traffic? These and related questions have been the subject of intensive investigation.

Brittle fractures in bridges in the 1970s. There have been at least 25 bridge members that have developed brittle fracture in the 1970s.

JUNE 13, 1970	BRYTE BEND BRIDGE, SACRAMENTO, CALIFORNIA
NOVEMBER 1970	YELLOW MILL BOND BRIDGE, BRIDGE PORT, CONNECTICUT
OCTOBER 1971	FREMONT BRIDGE, PORTLAND, OREGON
WINTER 72-73	I-80 SHELTON OVERPASS, NEBRASKA
OCTOBER 1973	QUINNIPIAC RIVER BRIDGE, NEW HAVEN, CONNECTICUT
WINTER 73-74	I-80 SALT CREEK, NEBRASKA
WINTER 74-75	LAFAYETTE STREET BRIDGE, ST. PAUL, MINNESOTA
WINTER 75-76	I-90 LACROSSE, WI/DRESBACK, MINNESOTA
WINTER 75-76	MINDEN, ONTARIO, CANADA
WINTER 76-77	I-57 NORTHEAST OF FARINA, ILLINOIS
WINTER 76-77	NEW YORK THRUWAY, MILEPOST 434.32
JANUARY 1977	I-79 NEVILLE ISLAND, PITTSBURGH, PENNSYLVANIA
WINTER 77-78	POPLAR STREET COMPLEX, EAST ST. LOUIS, ILLINOIS
WINTER 77-78	ROUTE 177 SILVER CREEK BRIDGE, MASCOUTAH, ILLINOIS
JANUARY 1978	DAN RYAN RAPID TRANSIT STRUCTURES, CHICAGO, ILLINOIS (3-CONSECUTIVE RIGID-FRAME BENTS FRACTURED)
WINTER 77-78	US23 3RD STREET VIADUCT, COLUMBUS, OHIO
WINTER 78-79	NAPIER AVE BRIDGE, BENTON HARBOR, MICHIGAN (3 GIRDERS FRACTURED)
WINTER 78-79	I-35 OVER GRAND RIVER, IOWA
WINTER 78-79	WEBSTER COUNTY BRIDGE, LEHIGH, IOWA (3 GIRDERS FRACTURED)

In addition to the bridges that have developed brittle fracture, hundreds of bridge members have been found to contain cracks and, therefore, had to be repaired — an expense involving untold millions of dollars.

Consider the case of one bridge that has been only 19 years in service but has been subjected to a heavy traffic count including 4 to 5 million loaded trucks. In a March 1981 inspection, 146 joints were given visual inspection; 107 were found to be cracked. It has been recommended that this 1080-ft, two-girder bridge be replaced (westbound lanes of the intercity viaduct in Kansas City, Kansas) to ensure the safety of the travelling public. Kansas City officials estimate a loss of $100 million for each year that the bridge is closed because of the impact on local economy, commuters and interstate traffic (I-70).

When the bridge carrying U.S. Route 18 over the Mississippi River between Prairie du Chien, Wisconsin, and Marquette, Iowa, was closed on January 16, 1981, because of cracking and defective steel, the Prairie du Chien area Chamber of Commerce estimated an annual loss of business of $80 million and projected a possible layoff of 144 workers. This bridge was opened to traffic in November 1974. Major repairs were deemed necessary to ensure the safety of the travelling public.

Not just bridges in trouble. In addition to highway bridges, many welded steel structures have developed cracking and/or brittle fracture in the 1970s. The following lists a few of these structures, all with welding-related problems:

January 1972	MARTHA INGRAM TANK BARGE (584 ft), broke in two starting at a weld.
January 1972	FORT HOWARD PAPER CO., GREEN BAY, WISCONSIN, building under construction, two roof girders fractured, 3 killed, 10 injured.
January 1978	HARTFORD CIVIC CENTER, HARTFORD, CONNECTICUT, complete collapse of roof (a few hours earlier, thousands could have been killed).
January 1979	225,000-TON SUPERTANKER BAYRIDGE, brittle fracture initiated dockside from a repair weld.
1979 - 1980	U.S. NAVY DLF ANTENNAS (1200 FT), over $1 million in weld repairs.
1971	BROOKLYN COLLEGE SCIENCE BUILDING, hydrogen cracking and lamellar tearing (over $1 million in repairs).
1978 - 79	LAKE PLACID'S WINTER OLYMPICS FIELD HOUSE, defective welding necessitated redesign and reconstruction (fabricator was bankrupted).

1974 - TRIDENT BALLISTIC MISSILE SUBMARINE OHIO, faulty welds contributed to excessive price overrun and delays.

There are many more examples that could be cited. The cost is staggering, and the greatest price may be yet to come – if a collapse causes loss of life.

Epilogue. In conclusion, I must apologise for such a long reply in giving my opinion on the need for cooperative generic technology centers.

There is a tremendous need for welding research, and I have hardly addressed the specifics of that problem because I see as most important what some consider an ancillary result of the proposed CENTER FOR WELDING OF METALS, viz., a marked increase in the number of welding engineers graduating from U.S. colleges and universities. Without well educated welding engineers, we should not expect to see great accomplishments in welding research, and without a highly visible U.S. Welding Institute, it appears that we will have neither the support of the colleges and universities nor the interest of prospective students to become welding engineers.

You may ask, can the present high incidence of weld cracking during and after fabrication be reduced in future fabrication? I believe that it can, and that no research is needed for this purpose. It will be necessary, however, to have the services of adequately trained welding engineers to give careful consideration to such vital (and sometimes neglected) details as (1) cracked tack welds (in weld metal and/or weld heat-affected zone), (2) consistent implementation of low-hydrogen practice, (3) control of "cosmetic corrections" and weld repairs, (4) control of cooling rates to preclude both brittle weld-transformation products in the heat-affected zone and loss of toughness in the weld metal, (5) use of welding con sumables that provide tough, crack-resistant weld metal, (6) designer review of welded connections at the shop-drawing stage, and (7) attention to the inspect ability of welded connections.

And to markedly reduce the incidence of cracking after fabrication, it will be necessary to have the services of nondestructive testing engineers and qualified ASNT Level-II inspectors capable of finding and sizing buried weld defects.

With an average of only about 20 BS welding engineers in the U.S. per year for the last 20 years (as compared with 2000 each year in the USSR), and currently about 800 persons majoring in materials science and metallurgical engineering each year in the U.S. and Canada (as compared with 8000 each year in the USSR), it is not surprising that welding engineers are seldom found in plants fabricating bridge girders. The FHWA advertised off and on for 3 years seeking an additional welding engineer to be my replacement on retirement They offered a starting salary of up to GS13 step 5 without success. FHWA has now given up the search and will send a civil engineer to school for a year to study welding and metallurgy to replace me on retirement.

Sincerely yours,

Carl E Hartbower

Carl E. Hartbower

Enclosure

BIOGRAPHICAL

Mr. CARL E HARTBOWER is presently employed as the Principal Welding Engineer for the Federal Highway Administration (FHWA). In this capacity he has been in a unique position to observe and document the welding-related problems that exist in the Interstate Bridge System.

Mr. Hartbower is a registered professional engineer in Massachusetts (Mechanical Engineering) and in California (Metallurgical Engineering).

- Fellow of the American Society for Metals (1980) "in recognition of contributions to the metallurgy and engineering of large-scale welded structures to the use of fracture mechanics in modern bridge design and fabrication, and to advance non-destructive testing techniques and inspection."
- Fellow of the Welding Institute (British), 1980.
- Life member of the American Welding Society,
- Member of the American Society for Testing and Materials, Chairman of Task Group E24.03.03
- FHWA Administrator's Award in 1979 "in recognition of his outstanding contribution in fostering the Fracture Control Plan and for leadership in the safety problems attendant to the fabrication of major bridges."
- Spraragen Award for best research paper published by AWS in 1968.
- Commander, Navy Civil Engineering Corps, USNR, Retired.
- Life member of the Naval Reserve association.
- Member of the Naval Institute.
- Navy Civil Engineer Corps Awards (1951 and 1952) for research papers on the explosion bulge test.
- Exchange Scientist - in April 1961, the U.S was visited by Professor N. N Rykalin of the Baykov Institute, Academician B. Ye. Paton of the Paton Institute, and Professor N. O Okerblom of the Leningrad Polytechnic Institute. In exchange, the National Academy of Sciences selected Mr. Hartbower as one of three Welding authorities to visit industrial and educational centers in the Soviet Union (see WELDING ENGINEER, p. 64, July 1962 and WELDING RESEARCH ABROAD, Vol. VIII, No. 2, February 1962).

Mr Hartbower has BS (1943) and ME (1950) degrees from Worcester Polytechnic Institute; was previously employed by the Naval Gun Factory (Welding Engineer), Naval Research Laboratory (Physical Metallurgist), Watertown Arsenal Laboratories (Chief of Metals Joining), and Aerojet General Corp. (Associate Scientist). He has published over 50 papers.

GENERAL MOTORS CORPORATION
GENERAL MOTORS BUILDING
DETROIT, MICHIGAN 48202

ROBERT F. MAGILL
VICE PRESIDENT

October 29, 1981

The Honorable
Doug Walgren
House of Representatives
Washington, D.C. 20515

Dear Mr. Walgren:

I am writing in response to your letter of September 3 to A. F. Houchens requesting General Motors views on implementation of the Technology Innovation Act of 1980 -- particularly on the need for cooperative generic technology centers.

As noted in the Act, the purpose of these research centers is to enhance technological innovation in the U.S. Innovation, of course, is vital to the well-being of the nation in terms of expanding the opportunities for domestic employment and maintaining our competitive edge in the growing international marketplace. Because technical innovation figures so importantly in our economic growth and prosperity, the question of the government's role becomes significant

During the past three years we have had the opportunity to present our views on legislation that would thrust the government into competition with private industry in the development of practical technology, including commercial products. We have consistently maintained that such a role is inappropriate and that any involvement by the government should be restricted to the area of basic research. For your information I have attached a copy of our statement of July 1981 before the House Science and Technology Committee, which goes into the matter of cooperative research in greater detail. While the statement addresses in particular the role of government in automotive research and development, we believe that role extends to any government research and development endeavor in the private sector. Thus, in implementing the technology center concept, as provided for in the Technology Innovation Act, we believe it is important that government participation and funding be limited to basic research.

Admittedly, the distinction between basic and applied research is not always precise, but as a guideline we believe the technology centers should confine their efforts to expanding new scientific knowledge and leave the application of the results of this basic research up to industry to pursue. As written, however, the Act would allow these centers to go well beyond conducting basic research and encourage the government to fund commercial product programs. We believe it is improper for government to use public funds in support of applied research that duplicates industry's efforts in the area of product development.

As the intent of the Act is to strengthen America's industrial and economic base, we believe government would better fulfill this intent by supporting programs that encourage non-inflationary capital formation and cost-effective regulatory reform. Accordingly, by implementing federal programs that free up limited corporate resources, industry would have more available funds to pursue programs of basic and applied research.

Thank you for the opportunity to present our views on this matter.

Sincerely,

Bob Magill

R. F. Magill

Att.

Statement of
General Motors Corporation
to the
House Subcommittee on Transportation, Aviation and Materials
# of the
Committee on Science and Technology
on
Government's Role in Automotive Research and Development

Presented by
John D. Caplan
Executive Director
General Motors Research Laboratories

Detroit, Michigan
July 7, 1981

Mr. Chairman, I am John D. Caplan, Executive Director at the General Motors Research Laboratories. Thank you for this opportunity to provide the Subcommittee with our views on the appropriate role of government in the area of automotive research.

The subject of government involvement in automotive R&D has been actively discussed for several years. In these discussions General Motors has consistently recommended that government involvement in automotive research should be limited to basic research, and should avoid areas of applied research or similar programs where the objective is to develop a commercially acceptable product.

Admittedly, the definition of basic research is not precise, but it can be roughly described as an effort to expand scientific knowledge and understanding rather than the application of such knowledge to the solution of specific technological problems. Thus defined, we believe that basic research is a legitimate area for government involvement and there is a wide range of automotive-related subjects that would seem to qualify under that definition.

Government research that goes beyond the discovery of new knowledge unavoidably places the government on a parallel path with industry. Such unnecessary duplication is an inflationary waste of taxpayer dollars. It is our view that the federal government should not be a competitor of the automotive industry, but rather a supportive ally of the industry.

While the research roles of industry and government are distinctly different, they are nonetheless closely related. To expand on this point, the auto industry can best discharge its responsibilities by continuing to concentrate its resources on applied research -- in other words, the application of known principles toward improved power plants and other vehicle components and systems, as well as fuels and materials to name a few. Meanwhile, we foresee substantial benefits if government concentrates its efforts on basic research in such areas as Biomedical Science, Environmental Science, Tribology, Material Science and other areas which would benefit not only the auto industry but many others as well.

To be more specific, let me outline some basic elements that we believe any government automotive research effort should include. First, as we have emphasized, government support for the advancement of automotive technology should be directed solely to basic rather than so-called applied research.

Second, the projects preferably should be viewed as open-ended commitments which can generate new knowledge applicable to automotive transportation -- but which may not necessarily have an immediate or near-term payoff. Such research programs may not yield beneficial results for several years. If Congress is serious in its considerations for an automotive research program you should recognize that programs of basic research must run across fiscal years. Short-term federal commitments to long-term research needs will surely lead to an inferior effort and questionable results.

Third, a successful basic research program requires a highly qualified research directorate and staff. The program director, for example, should be selected from among the nation's most respected and qualified scientists and should have demonstrated the ability to successfully manage basic research programs.

Fourth, it is essential that industry be involved in selecting the research areas and in defining the objectives. This will help ensure that the projects are related to the needs of the industry and that the output will be utilized.

Fifth, whatever government agency directs the research effort, it is imperative that staffing be separate and independent of any other primary activities. More specifically, a government-operated basic research program must not be related to regulatory matters involving industry.

Sixth, and last, whatever basic research programs the government may undertake, they should be subject to the scrutiny and guidance of an independent advisory board. Independent peer oversight is necessary to minimize parochial research interests, and to evaluate program progress and program effectiveness.

To sum up this outline, government should concentrate on the high-risk, long-lead time programs of basic automotive research that also may provide knowledge and understanding for other segments of society. It is our observation that government research functions best where it has capabilities and experience. Government-sponsored fundamental research is better utilized than are efforts at product development and commercialization in the civil sector.

With respect to the proposed "National Automotive Research Act," we have commented on this bill in the previous Congress and our position remains the same. We agree with the intent of the legislation and its objectives to:

-- increase fuel efficiency, safety and reliability

-- decrease dependence of foreign petroleum

-- reduce adverse environmental effects

-- conserve scarce resources

-- enhance personal mobility at reasonable cost

-- improve the international competitive position of American automotive products

However, we believe this legislative proposal goes well beyond the discovery of new knowledge and would have the government working on a redundant path with industry. In our view, the legislation would allow, if not encourage, the government to duplicate industry's effort in the area of product development. Technology development -- the application of the results of basic research -- should be left in the hands of industry,

Finally, we want to point out that government can do much to assist the industry by eliminating all unnecessary and costly regulations that have been imposed on industry while at the same time enacting balanced spending programs that encourage long-term capital formation. A total package of necessary automotive regulatory changes and broad regulatory reform measures, coupled with non-inflationary capital formation programs would go a long way toward helping to restore vitality to our industry.

During the past seven years General Motors has spent more than $10 billion to comply with federal, state and local government regulations. In 1980 alone, we required the equivalent of 25,000 full-time employes to comply with all regulations. Most importantly, over the past decade, GM research and development spending to meet federally imposed or anticipated automotive safety, emissions and fuel economy standards, accounted for close to one half of GM's R&D budget. We believe the greatest cost of unnecessary regulation is in the lost research opportunities through which innovations are developed into marketable products. By eliminating unnecessary regulations, we will be able to devote more of our resources to the research which is needed to improve our products and increase our productivity.

To this end, the Reagan Administration has done, and is doing, much in the areas of long-term economic development and regulatory reform. This is most encouraging from my perspective as a research manager because such programs should free up limited corporate financial resources for programs of basic and applied automotive research. However, without Congressional support for his efforts, the President's programs cannot realize their full objective of making our nation's industry truly a world competitor.

In conclusion, General Motors is not opposed to the concept of government-sponsored automotive research, provided such research is directed toward basic research that would expand scientific knowledge applicable to the domestic auto industry. We believe that government research involvement of a basic nature can make a major contribution to the generation of new knowledge. We welcome this form of research endeavor, provided it adheres to the organizational elements along the lines we have suggested.

However, as it is the intent of this hearing to determine what government programs are most desirable for aiding the domestic auto industry, we would prefer government programs to remove excessive tax and regulatory burdens on the private sector rather than federal

R&D programs. We believe programs to eliminate unwarranted barriers to private initiative and its counterparts -- strong economic growth, high employment and a low inflation rate -- are essential to our industry and nation's long-term viability.

Mr. Chairman, that concludes my prepared remarks. I will be pleased to respond to any questions the Subcommittee may have.

* * *

FREIGHTLINER

FREIGHTLINER CORPORATION

4747 N. CHANNEL AVE.
P.O. BOX 3849
PORTLAND, OREGON 97208
503/283-8000

September 29, 1981

Mr. Doug Walgren
Chairman
Subcommittee on Science,
Research and Technology
U.S. House of Representatives
Suite 2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Walgren:

Rather than comment on the implementation of the act, I would rather address the need for Cooperative Generic Technology Centers (COGENTS). As you are well aware, industrial research and development has become increasingly costly. Corporations must be very sure their R&D dollars get maximum utilization. As a result, many corporations are forced to focus their R&D dollars on areas which will increase their immediate market competitiveness. Other not so immediate interests are placed on hold or ignored completely.

COGENTS would be extremely helpful in alleviating this situation. For a minimum expenditure, corporations would have access to technical resources which would otherwise be unavailable. Additionally, the cooperative nature of this venture is more likely to get the technology developed into utilization quicker and on a much broader scale.

Freightliner's past experience with cooperative ventures, which include the Western Highway Institute, Oregon Graduate Center - Materials and Welding Consortium and the Society of Automotive Engineers - Technical Committees, has always been fruitful and returned much more than the initial investment. I hope that COGENTS can become a reality since I'm sure they'll foster a rebirth of technological innovation in the U.S., as well as provide a maximum return for the R&D dollar.

If I can provide any further assistance, please feel free to contact me.

Sincerely,

Ray W. Murphy

Ray W. Murphy
Director
Research and Development

RWM/mka

The Oregon Graduate Center
for Study and Research

August 31, 1981

Honorable Doug Walgren
Chairman
House Subcommittee on
Science, Research &
Technology
2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

The Oregon Graduate Center, a private, educational and research center located in the suburbs of Portland, Oregon, was established in 1963 by a group of industrial leaders for the expressed purpose of creating graduate study programs granting Masters and Ph.D. degrees in selected scientific and engineering disciplines. Since its inception, the Graduate Center has become a national resource, undertaking basic and advanced applied research for industrial firms as well as various government agencies. It has been a leader in providing a small number of excellent scientists and engineers with advanced degrees who have found employment in some of the leading firms and universities in the United States. The Oregon Graduate Center will be affected by any legislation that places additional emphasis on the need for advanced research and education of scientists and engineers. In the past, the United States has neglected having an avowed policy to develop its economic and business enterprises, research, and technologies to the extent that, as a nation, it could remain competitive in world markets. More importantly, past government policies have reduced our abilities to pre-empt the technological capabilities of any real or potential adversary. It is with this in mind that we would like to offer the following in testimony and support of the Stevenson-Wydler Act.

1. Currently, in several industrial segments, the United States has lost its competitive edge, innovative ability (in terms of innovation implementation), and interest in funding basic, applied, and developmental research that would have kept the industry technologically competitive and viable. We have been shown by West Germany, and by Japan in particular, how many of the innovations developed in the United States can be applied in a manner that is superior to those who actually invented the technology. There is clearly a need for correcting the situation and increasing the amount of innovation and improving the productivity of our individual firms and industries in general. The Stevenson-Wydler

Act is conceptually one way of insuring increased innovation and stimulating increases in productivity. Recognizing the fact that no funding was available for this highly desirable act, there are some alternatives that we would recommend.

a. It must be initially recognized that Government does have a role in organizing and leading the private sector, when industry fails to respond to challenges or threats by foreign governments and industrial firms. Those roles that government can play are:

   1) Assuming leadership.

   2) Developing incentives for the private sector.

   3) Eliminating any inhibitors or barriers to innovation or increases in productivity, such as needless regulations and restrictive trade practices.

   4) Balancing the economic needs with social needs.

   5) Government can perform economic data collection and analysis to provide insight that would convince individual industrial firms or industries of the merit of research expenditures and/or expenditures that result in increased productivity.

   6) Government can mold public opinion to influence the economic behavior of industrial firms just as it has done in social areas of equal employment opportunity; employee rights, benefits, and safety; and social accountability of the firm's actions.

   7) Government can coordinate the allocation of research funds from a number of government agencies to implement policy directives.

   8) Government agencies and departments can negotiate a variety of agreements with foreign governments that allow U.S. industries or individual firms to compete in foreign markets on equal terms and to acquire the rights to utilize some of the technologies developed in foreign countries.

There are undoubtedly other means by which government can support the intent of the Stevenson-Wydler Act. Perhaps, because of the lack of funding for this act, more creative approaches can be developed which draw upon already existing organizations of government and the private sector; and through more cooperative efforts between government and industry, similar to that practiced in Japan and West Germany, the U.S. can better utilize the scarce resources to increase the innovative activities and increase productivity.

The Oregon Graduate Center, a private research and educational center, stands ready to support the concept of the Stevenson-Wydler Act and other acts that are designed to increase the competitiveness of U.S. industry in the world markets. We think that an era of more cooperative attitudes between government and the private sector is a major step in developing more detailed programs that will enhance the competitiveness of the United States in the world market.

Sincerely,

L. E. Murr

L.E. Murr, Ph.D.
Vice President for
Academic Affairs
and Research

Zane K. Campbell

Zane K. Campbell
Vice President for
Industrial Affairs

ZKC:dr

LEM/ZKC:dr

STATEMENT

Submitted to:

The U.S. House Committee on Science and Technology,
Subcommittee on Science, Research and Technology,

"Notations on State Legislative and Executive Perspectives
Regarding Implementation of the Stevenson-Wydler Technology
Innovation Act (PL 96-480)"

In support of the Subcommittee's hearings on PL 96-480
chaired by the Honorable Doug Walgren,
July, 1981,
Washington, D.C.

by

Rhett D. Speer*

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* These statements are submitted as an independent witness: Mr. Speer is formerly associated with the Science and Public Policy Program and the School of Civil Engineering of the University of Oklahoma, and the U.S. Corps of Engineers' Waterways Experiment Station and the Oklahoma Legislature. Mr. Speer is currently a member of the State and Local Subcommittee, Committee on Science, Engineering and Public Policy of the American Association for the Advancement of Science; and is Director of the Natural Resource Information Systems Project of the National Conference of State Legislatures.

INTRODUCTION

Mr. Chairman and members of the Subcommittee on Science, Research and Technology: I am pleased to submit this testimony as a contribution to your inquiry concerning implementation of the Stevenson-Wydler Technology Innovation Act.

My purpose is to offer some recommendations on achieving the goals of the Act as they relate to state-level policymaking resources: remarks will be restricted to state legislative and executive government. Before I describe how I think you should spend some of the taxpayers money, allow me to note a few brief thoughts on the states' particular history and needs.

SCIENCE AND TECHNOLOGY NEEDS OF STATE GOVERNMENTS

(1) State executive and legislative branches are different in many ways, but both share a need for more specific, detailed, and local-oriented information. Simply put, the states need access to science and technology resources in the form of knowledgeable personnel, adequate data in appropriate format, and efficient transfer mechanisms that can provide information in support of effective policymaking.

Over the last decade, the states' demand for science and technology resources has increased as a result of the number and complexity of the issues they face; moreover, the states have explored and increased their capacity to take advantage of science and technology resources.[1]

(2) The federal establishment is one of the best available sources of the kinds of science and technology resources needed by states.

For many state issues, the level of resources required to make effective policy far outstrip the states' ability to pay. The federal government is better equipped than the states to provide the necessary R&D, and the technical resources associated with R&D activities, in support of state policymaking.

(3) States should be able to interpret and adapt technologies to current policy issues.

The states need appropriate resources that will enable wiser choices among the technologies available to solve a particular problem: state and regional variations in social, environmental and economic conditions preclude blanket adoption of technological fixes in many cases. States have often been hindered in flexibility by their lack of participation in federal policy and their inability to obtain appropriate resources.

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[1] See discussions of state science and technology capacity building efforts in "Increasing the Capacity of State Governments to Access Scientific, Engineering, and Technical Resources" by Waldhorn, et al, SRI International, August 15, 1981; "The State Science, Engineering and Technology Program: An Evaluation of Lessons Learned During the Planning Phase" by Ivy and Hogan, National Conference of State Legislatures, June, 1981, Denver, Colorado; and "State Legislatures' Response to the State Science, Engineering and Technology Program" by Reuss and Mack, National Science Foundation, August, 1978.

(4) There is a conflict between the political needs of state officials and the way in which they often receive information from the Science and Technology community. A successful exchange of technology from the science commmunity (including federal agencies) requires not only that policymakers be educated, but also that the science community be educated to the policymakers' requirements.

CONCERNS AND RECOMMENDATIONS

The foregoing points beg questions regarding the definitions of the tasks called for in the Act and the nature of the work required to accomplish those tasks. These questions are more important now than ever in light of the directions being taken by the current administration to return the management of many programs back to the states. More state responsibility will create a heavier demand for access to science and technology information. Without appropriate access to resources from the federal community, the states will not be able to carry out their increased, and potentially cost-effective, reponsibilities. The following statements are intended to 1) address concerns specific to Section II and 2) make some general recommendations which take Section II and other sections of the Act into account as the Act is implemented.

The term "application assessment" is ominous. If the assessment is to be no more than a form filled out to comply with the requirements of the Act, the Act will lose its primary significance in transferring technology. Any assessment, to be meaningful, must address an appropriate range of policy information needs on a level specific enough to be of use to a particular state problem. For example, it is not useful for a policy-maker to know that remote sensing technology can observe the earth at such-and-such a resolution; it is useful to know that the same technology can identify the extent of pine-bark beetle kill on state-owned forests so that policy-makers can propose appropriate changes in state forest-management practices. Second, by what criteria will a technical laboratory use to determine that a research and development project is "applicable" in a state policy context? Would laboratory personnel involved in developing radioactive tracer techniques be knowledgeable of the potential application to a state's groundwater management program? If yes, would the same personnel be able to successfully apply the technology in a political setting as opposed to a bench or pilot scale demonstration? Even a laboratory person so designated as a full time technology transfer agent, with a talent for applying science and technology to public policy, may not be knowledgeable of the particular regional science and technology policy information needs.

Subsection (c)(2) of the Act calls for the dissemination of federal information on federally owned or originated products, processes and services. Most federal information having benefit in a science and public policy context finds its way to the wrong place at the wrong time. That there is "too much information" makes little sense to this observer - we need all we can get. Packaging and timing are the two key elements of dissemination: the data must be in a form policy makers can digest, and the data must be available only when it is needed. Furthermore, "products, processes, and services" have their own, individual formatting requirements for proper dissemination.

There are four types of technical assistance to states commonly performed by public interest and other groups that relate to Subsection (c)(4)[2]:

1) Information services are "vertical" provisions of information from a federal agency to an audience; the information may be provided directly by the agency or through a "broker";

2) information exchange is a "horizontal" process whereby information is shared by users and providers alike; computer conferencing is such an example, clearinghouses that broker information between users and providers is another example;

3) convening is a form of assistance that brings together various parties-of-interest to exchange information face-to-face;

4) assessments, case studies, or agenda setting comprise a set of assistance activities that usually require a greater degree of analysis or participation on the part of the resources provider or broker.

All of the above are valuable forms of technical assistance and the various elements are often combined in actual practice, e.g., information services and exchange. All require a great deal of time and attention.

At the risk of being simplistic, it is suggested that Subsection(c)(3) "...cooperate with and assist other organizations which link the research and development resources...to potential users in state and local government..." is the key to the successful nuts and bolts operation of the Research and Technology Applications Offices. Application assessment preparation, dissemination and technical assistance may all be enhanced significantly by identifying state level personnel and public interest groups and utilizing this expertise in the design and implementation of the tasks charged to the Offices.

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[2] For an expanded treatment of the ways in which federal information gets into the hands of state government see "Diffusion and Utilization of Scientific and Technical Knowledge Within State and Local Governments," by Feller, Pennsylvania State University Institute for Policy Research and Evaluation, Center for the Study of Science Policy, University Park, February, 1979.

Some examples of organizations in-place that could be of aid to the Offices include (approximate numbers) 28 state legislative science offices, 12 state executive staff scientists, 4 public interest group science and technology organizations, and numerous institute-type organizations that support the state legislative and executive policymaking efforts. The character of these spans the range from a single science advisor to full blown institutes that perform basic research. While these organizations are unable in most instances to provide extensive resources to their constituents, they do represent an important link to the various constituent groups who are the intended users of federal science and technology. In fact, the highest potential benefits that can be derived from these groups from a federal perspective is that they may serve to multiply the utilization of science and technology to their constituent groups. Some of these organizations have gained a respectable amount of experience in state level science and public policy matters over the last decade, and are sensitive to the concerns of their constituents needs as well as aware of interests at the federal level. With these ideas in mind I would make the following minimum recommendation:

That a special task force be named from among the various state level science and technology organizations. It is envisioned that the Task Force would serve to advise and guide the parties responsible for implementing the Act and provide feedback to Task Force Member constituent groups.

A) The Task Force would support the Board by assessing the extent to which state level government involvement would forward the objectives stated in Section (5)(c), specifically (5)(c)(2,4,5 and 7).

B) The Task Force would serve in an advisory capacity to the Federal Laboratory Consortium and the National Science Foundation in dealing with state governments.

C) In consultation with the Offices of Research and Technology Applications, and such appropriate entitites as the National Science Foundation (to include the Office of Intergovermental Programs), the Executive Committee of the Federal Laboratory Consortium, The President's Advisory Panel on Intergovernmental Science Engineering and Technology, the Science and Technology Group within the Program Analysis Division of the General Accounting office, the Advisory Commission on Intergovernmental Relations, and the Science Policy Division of the Congressional Research Service, the Task Force would provide an assessment from the states' point of view to the Congress concerning the overall implementation of Section 11 of the Act toward the goal of improving the procedures to implement the various tasks.

D) The Task Force would further be expected to report its findings back to the constituent groups represented.

This concludes my statements. I thank you again for this opportunity.

BINGHAM-WILLAMETTE COMPANY
A DIVISION OF GUY F. ATKINSON COMPANY
PORTLAND, OREGON 97210

WM. E. THARP
CHAIRMAN

September 16, 1981

Committee on Science and Technology
U. S. House of Representatives
Suite 2321 Rayburn House Office Building
Washington, D. C. 20515

Attention: Mr. Doug Walgren, Chairman
Subcommittee on Science,
Research and Technology

Dear Mr. Walgren:

In my opinion the Stephenson-Wydler Technology Innovation Act of 1980 needs to be implemented as soon as a program can be worked out.

As you know private industry is spending billions of dollars every year on research.

Most of this money, however, is expended in a problem-solving nature and not to build up a reservoir of scientific technology.

If the United States desires to attain or retain a world position of leadership in this vital area, some government funding and leadership is going to be required.

The participation of higher levels of the academic society along with some funding from private industry is a must.

Not too many chief executive officers of private industry have a Doctorate degree. This program would need this level of input.

Sincerely,

Wm. E. Tharp

Wm. E. Tharp

Southern Pacific Company

Southern Pacific Building, One Market Plaza, San Francisco, California 94105

B. F. BIAGGINI
CHAIRMAN

September 16, 1981

The Honorable Doug Walgren
Chairman
Subcommittee on Science,
Research and Technology
Committee on Science and Technology
U.S. House of Representatives
Suite 2321 Rayburn House Office Bldg.
Washington, D.C. 20515

Dear Congressman Walgren:

Thank you for your letter of September 3, requesting my opinion on implementing the Stevenson-Wydler Technology Innovation Act and my comments on the need for cooperative generic technology centers.

Through the cooperative efforts of individuals from our research and engineering departments and the staff at Oregon Graduate Center, a new method of welding rails together through the electroslag process has been developed. It is anticipated that this method will provide an improved, as well as a more economical method of welding rails in the field.

Similar projects would be facilitated by the formation of Cooperative Generic Technology Programs such as that proposed by the Oregon Graduate Center; a Center for Generic Technology (COGENT) in Welding and Joining.

If Public Law 96-480 [S.1250], Stevenson-Wydler Technology Innovation Act of 1980 were implemented so that the COGENT Center could be formed, we would support it through our research and development effort and our technological investment.

Sincerely,

B. F. Biaggini

cc: Dr. William E. Wood
Chairman, Materials Science Dept.
Oregon Graduate Center
19600 N.W. Walker Road
Beaverton, OR 97006

STATEMENT OF
RUDOLPH L. YOBS
DIRECTOR
GEORGIA PRODUCTIVITY CENTER

BEFORE: Subcommittee of Science, Research, and Technology, House Committee on Science and Technology

SUBJECT: P. L. 96-480 Stevenson-Wydler Technology Innovation Act

DATE: July 14, 15, 16, 1981

Mr. Chairman and Members of the Committee:

I appreciate the opportunity to present to this subcommittee my views concerning innovation and productivity. In so doing I will share with you some of our experience and accomplishments at the Georgia Productivity Center. Organizationally the Georgia Productivity Center is a part of the Engineering Experiment Station at the Georgia Institute of Technology. Georgia Tech has a strong record of innovation assistance to existing industry which extends back over twenty years. A formal program of technical assistance to business and industry was begun at Georgia Tech in 1961 at the same time that we opened our first field office. This program is now carried out through eight field offices and reaches over 800 companies per year. Because of our successful experience in technology transfer and innovation the Georgia General Assembly designated our organization as the Georgia Productivity Center in 1975. The legislation designating Georgia Tech as the Productivity Center calls for it to "promote efforts which will stimulate the adoption of new methods and technology in all sectors of the economy."

The Productivity Center emphasis is in four major categories: Innovation, Research and Development, Safety and Environmental Counseling, Human Resources. The attached newsletter articles describes each of these areas in greater detail. Our basic mode of operation involves the use of extension engineers based in field offices located around the state and supported by technical specialists in Atlanta. The extension engineer gets to know the manufacturers in their multi-county area and these companies bring their needs to our attention. We then work closely with people in the plant to clarify the problem and recommend action. Primarily, we try to help them help themselves. We may refer them to other sources of help, e.g. suppliers or consultants. We try to follow through to maintain contact because many of these things take a good bit of time to bring to completion. We use a guideline of five man-days of assistance without charge on a particular problem. Sometimes a company will want us to do more for them and we will enter into a cost-reimbursement type contract with them for that. In any event, we always keep in confidence information which a company has provided to us. We have learned two things from our twenty years of experience which we believe are most important. One, is the direct, in-plant assistance by an industrial extension engineer is the most effective form of technology transfer which produces innovation. The other is that such assistance can pay large dividens. We normally don't make claims about cost savings in specific companies but do try to make some estimate of our impact for our own purposes.

At one point the A. D. Little Company identified a cost-benefit ratio of 22:1 for our program in the manufacturing sector. Savings through the closely related industrial energy conservation are even more dramatic. For the 38 month period August 1977 -- September 1980 we identified actual savings of $162 million resulting from 554 plant visits and 204 complete audits. Such savings are in part due to the extension engineer approach which permits follow up visits to help in the implementation of recommendations.

Georgia Tech has always focused its efforts on manufacturing and particularly small and medium sized companies which usually lack strong technical resources of their own. Not only are Tech's capabilities concentrated around technologies appropriate to manufacturing but we also believe it to be central to our state's future economic growth. Manufacturing employment is the largest segment of Georgia's work force with well over one-half million employees working in over 8,000 manufacturing firms. Manufacturing employment total more than mining, construction, utilities, transportation, finance, insurance, real estate, and agriculture combined. Manufacturing is also the largest wealth producing segment of our state's economy. Jobs in manufacturing are particularly important in rural areas where agricultural workers are displaced by farm mechanization. These jobs keep people at home, rather than forcing them to migrate to large cities.

The key to maintain this strength is to give workers more efficient tools and more effective ways of using them; that's what innovation is all about. The primary means for increasing industrial output is through improved technology. In a report prepared by the U. S. Department of Labor it was found that technology contributes more to productivity (72%) than any other factor.

New technology is particularly important to small industry and our state's economy is highly dependent on small companies. According to Georgia Department of Industry and Trade data over 78% of the manufacturing firms in Georgia have fewer than 99 employees. Small companies have the same problem as big companies (product design, engineering, production, quality, purchasing, etc.) but the small manager has to wear all of these hats. Because of the limited amount of time available to investigate new technology, the growth of these firms is impeded.

Currently, our state's greatest source of industrial growth comes from the expansion of existing industry. Annual statistics document that while new plant locations are important to Georgia, over 60% of the new jobs which are created come from the expansion of existing industry. Large companies have experienced significant growth because of technological advancements and Georgia's small industries can achieve similar growth through innovation and the proper application of technology.

As we look to the future we expect small and medium manufacturing to continue to be the backbone of our economy and the source of much of our growth. But we realise that the typical plant owner-manager is going to be operating in an environment which is going to be extremely competitive and characterized by high interest rates and more demanding expectations of their customers, their workers and the community at large. All of these will require a high degree of efficiency, attention to quality and the careful use of resources if he is to remain profitable. His need will be greater than ever for a reliable, competent and easily accessible source of help to sort out conflicting equipment claims, analyze needs, learn the latest technologies and understand new product standards.

The technology transfer and innovation assistance of the Georgia Productivity Center extends beyond individual companies. We work closely with the Georgia Business and Industry Association, the Georgia Textile Manufacturers Association, and other trade groups in our state. Our program operates with guidance of a 20 member industrial advisory committee which meets regularly to review our program and make suggestions. This committee has members from all sizes of companies and represent a cross section of Georgia industry.

National productivity improvement is the bottom line and accelerated innovation offers the greatest promise for producing this improvement. I believe the objectives of this law are quite sound and should contribute significantly to the economic vitality of our nation. I appreciate the opportunity to present my views to this subcommittee and commend you for your work.

PRODUCTIVITY
IN ACTION
GEORGIA PRODUCTIVITY CENTER
GEORGIA TECH ENGINEERING EXPERIMENT STATION, ATLANTA, GA

December 1980 Vol. 1, Number 4

R & D for Productivity

Georgia Productivity Center Computer Research and Development

Investments in research and development have provided the foundation for most of the technological advances which industry uses today. Unfortunately the U.S. share of all world science and technology has fallen from approximately 33% in 1967 to less than 25% in 1980. Because of world competition, the time is long past when U.S. industries can rest on their scientific laurels. Increased R&D must be undertaken and new technologies made operational.

At the Georgia Productivity Center over 550 scientists and engineers work on R&D projects ranging from computer systems to solar energy. The primary R&D activities of the Georgia Productivity Center fall into three major categories.

• ELECTRONICS

In electronics R&D, engineers have developed energy management systems run by computers which control and monitor power usage. These computer systems conserve energy in large industrial, commercial, or public facilities.Electronic computer systems have also been developed to assist in design of electronic components for cars. The Center has created and assembled an interactive computer system which combines the capabilities of both humans and computers to solve problems ranging from material handling routing to structural design. Simulation, system analysis, and software research are also important parts of the Productivity Center's R&D programs.

• ENERGY

The current need for new sources of energy has resulted in research projects to produce ethanol from wood, increase solar energy efficiencies, and develop methods for the production of synthetic fuels. The Productivity Center team currently has extensive pilot test facilities for wood gasification, ethanol production, and solar fluidized bed reactions. Energy R&D is also encouraged by a fuels analysis lab which tests and evaluates alternate fuels for use in internal combustion engines.

• MATERIAL SCIENCES

The R&D activities in material sciences at the Georgia Productivity Center are enhanced because of the sophisticated array of equipment available for examination of materials. The Productivity Center has the most extensive problem-solving analytical instruments in the entire southeast for analyzing and identifying the characteristics of materials. Currently major research and development projects are underway in the following areas: use of activated carbon for chemical removal and improvement of water quality; surface chemistry/coatings; LASER hardening; adhesive bonding; composite material; failure analysis; and corrosion reduction. Industrial clients vary from steel wire manufacturers to firms producing plastic consumer goods.

There are many other diverse projects which the scientists and engineers of the Georgia Productivity Center have undertaken. All of these activities contribute to Georgia's technological development. For further information or assistance concerning Research and Development, contact Robert Hawkins, Georgia Productivity Center, Georgia Institute of Technology, Atlanta, Ga., 30302, 404-894-3836.

PRODUCTIVITY
IN ACTION
GEORGIA PRODUCTIVITY CENTER
GEORGIA TECH ENGINEERING EXPERIMENT STATION, ATLANTA, GA

February 1981 Vol. 2-No. 1

Safety and Environment Counseling

During the past twenty-five years American society has experienced a significant increase in the number of regulations which affect daily life. This increase has been most profound in the business sector where capital has been required to comply with an ever increasing number of safety and environmental regulations. To assist Georgia's business and industry in this area of regulation compliance, the Georgia Productivity Center conducts programs in safety and health counsultation and environmental compliance.

The safety and health program is operated in conjunction with Ga. Tech's field office network and provides confidential, on-site consultation services for those companies in Georgia that are concerned with the safety and health of their employees. This free service is independent of any governmental safety and health compliance and enforcement activity.

The immediate effect of this service is that Georgia employers have an opportunity to achieve voluntarily an in-compliance status in regard to federal regulations and standards. The ultimate benefits include not only avoiding possible noncompliance citations and fines, but also reducing the potential for employee injury and illness, boosting morale and efficiency, decreasing insurance and other operating costs, and increasing profits for business and industrial firms in Georgia.

The scope of a consultation visit depends entirely upon the employer's request. It may range from providing assistance on a very specific safety or health problem identified by the employer to an in-depth safety and health audit of an entire company operation. Where possible the Georgia Tech staff will suggest economical and practical solutions to identified safety and health problems.

A GPC specialist points out appropriate safety equipment and procedures during an on-site discussion

A further regulatory area which has required vast investment is environmental protection. Industries have spent billions on both air and water pollution control equipment and additional large sums of money are required for the operation of equipment and processes. At the Georgia Productivity Center, environmental assistance projects are conducted involving evaluation of state-of-the-art technology, equipment effectiveness, protential for recycle and by-product recovery, energy efficiency, and cost effectiveness. The sophisticated analytical capability of the Engineering Experiment Station is available to assist Georgia industry in complying with environmental regulations. Water analysis for metal and organics, air sampling for asbestos, sludge characterization for toxic substances and other required analyses can be obtained through the Center. The use of this resource allows Georgia business to avoid the major equipment and personnel cost required to perform these services in-house.

In conducting today's business, industry is faced with a multiplicity and diversity of regulatory problems. The Georgia Productivity Center is well qualified to analyze the economic and technical factors involved in plant safety/pollution control and develop economical and efficient solutions to these problems. For further assistance contact Robert Hawkins, Georgia Productivity Center, 404-894-3836.

PRODUCTIVITY IN ACTION
GEORGIA PRODUCTIVITY CENTER
GEORGIA TECH ENGINEERING EXPERIMENT STATION, ATLANTA, GA
August 1980 Vol. 1 Number 2

Innovation Improves Productivity

Innovation is synonymous with doing things better and it is essential for productivity advances. Today our productivity suffers because of a backlog of unapplied technologies. Market statistics suggest that technology is far ahead of our industrial sector's ability to absorb it. Transferring and implementing both new and unused technology is the key to substantial productivity gains during the next decade.

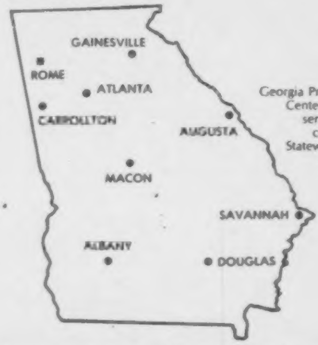
At the Georgia Productivity Center (GPC) the program for innovation operates through a statewide system of eight field offices operated by Georgia Tech. Having engineering and management specialists in each area of Georgia is of obvious value: The Georgia Tech team has both first hand knowledge of industrial and community needs in their areas as well as direct access to the resources of the academic and research units of Georgia Tech in Atlanta.

This statewide system of Georgia Tech offices was established in 1961 and the network's goal is to boost productivity for the state's business and industry. The innovation and technology transfer activities of these offices are interdisciplinary and are directed towards small and medium size firms located in areas of Georgia where technical resources are limited. The majority of projects are short term in duration and normally involve assistance in manufacturing processes, facility planning, materials handling, methods improvement, and cost control. To gain maximum benefits, the scope of this technology transfer program includes assistance to all types of industry.

Typical projects in manufacturing innovation have included: evaluation recommendation of automatic screw and assembly machines; assistance in upgrading paint finish techniques and equipment; analysis of CNC machine centers, preparation of numerous plant layouts; selection and design of conveyor equipment; guidance in preparing formal manufacturing procedures; design and installation of electronically controlled transfer equipment; complete product cost analysis in the design of welding fixtures to reduce direct labor hours in production; and prediction of bearing failure using vibration analysis techniques.

A further area of innovation, which is an outgrowth of today's energy crisis, is innovation/technology transfer for energy conservation. When energy was cheap and labor was expensive, industries quite logically sought to substitute machinery for labor without regard for whether the machinery was energy efficent.

Today energy is an expensive factor in production and innovation is absolutely necessary. The GPC direct technology transfer consists of methods both to save energy and to reclaim waste energy - plugging steam leaks, installing heat exchangers, recycling heat, and building higher energy efficiency into plants and equipment, often by the use of electronic technology.



Georgia Productivity Center provides services with convenient Statewide office locations.

Innovation is essential for productivity improvement and the Georgia Productivity Center is ready to assist you with your innovation efforts. Contact Robert Hawkins, 404-894-3836, for information on how the GPC office in your area can make your business more productive and profitable.

PRODUCTIVITY IN ACTION
GEORGIA PRODUCTIVITY CENTER
GEORGIA TECH ENGINEERING EXPERIMENT STATION, ATLANTA, GA.

Vol. 1—No. 1, June 1980

Challenge: Improve Productivity

Improving productivity will be a major challenge to business and industry during our coming decade, particularly to small and medium size firms. Recognizing the role of technology in productivity improvement and so that one organization in the state would relate to national efforts, the Georgia General Assembly designated Georgia Tech's Engineering Experiment Station as the state center. This action made Georgia the first state in the country to have a State Productivity Center.

The Georgia Productivity Center works to encourage productivity improvement through programs for innovation, research and development, safety and environmental counseling, and human resources. In all these areas, total factor productivity is considered, including labor, capital, energy, and materials.

• INNOVATION

Productivity suffers today because of a backlog of unapplied technologies. Through the state-wide network of eight Engineering Experiment Station offices, industrial extension is conducted for productivity improvement ranging from material handling methods to energy conservation.

• RESEARCH AND DEVELOPMENT

Technological progress does not just happen, it requires R&D. At the forefront of productivity advances is electronics technology and the Georgia Productivity Center has substantial involvement in electronics R&D. Activities include microprocessor development, robotics, software applications, and alternate energy development.

• SAFETY AND ENVIRONMENTAL COUNSELING

Because of regulations, a growing percentage of new equipment purchases are mandated by safety and environmental requirements. To assist Georgia's business and industry in this area, the Georgia Productivity Center conducts programs in safety and health consultation and environmental compliance. Services range from confidential, on-site safety and health consultation to the development of economical waste treatment solutions for air/water emissions.

• HUMAN RESOURCES

Very often people are an untapped resource for increasing productivity. This area of human resources at the Georgia Productivity Center includes expertise in both industrial psychology and engineering. Motivation and measurement of performance, training, incentive compensation, and organization design are primary elements of the program.

Benefits of improvement productivity can be numerous and inter-related. At the Georgia Productivity Center there is a commitment to improving business and industry. Individuals interested in learning more about the Georgia Productivity Center are encouraged to contact: Georgia Productivity Center, Georgia Tech Engineering Experiment Station, Atlanta, Georgia 30332, 404-894-3404.

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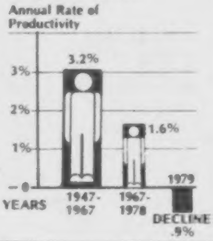
Current Productivity Decline

Between 1947 and 1967, private business productivity had increased at an average annual rate of 3.2%, but between 1967 and 1978, the growth rate fell by half, to 1.6%. In 1979, according to the Labor Department's most recent figures, out-put per hour worked actually declined to 0.9% from 1978.



PRODUCTIVITY IN ACTION
GEORGIA PRODUCTIVITY CENTER
GEORGIA TECH ENGINEERING EXPERIMENT STATION, ATLANTA, GA

October 1980 Vol. 1 Number 3

New Ideas for Productivity

Technological progress does not just happen, it requires planning, investment and commitment. Also, new technology is useless unless sooner or later it impacts upon industry and the economy. To accomplish this objective the Georgia Productivity Center has created a new Center for Manufacturing Technology. The Center's initial emphasis will be on educating Georgia manufacturers about new technologies and accelerating their use in the state. The first of four workshops planned for this year was conducted on September 26 and focused on programmable industrial control devices. The first workshop was attended by manufacturers representing a wide variety of Georgia industries, from textile products to metal fabricators

The Center's future workshops will concentrate on increasing industrial productivity in four major areas:

- Industrial Controls, including programmable controllers & computer applications.
- Industrial Robots for assembly jobs and jobs in hazardous environments.
- Improved manufacturing control systems, including productivity measurements.
- Instrumentation for detecting and predicting machine failures.

The presentation of workshop materials will vary somewhat with the subject, however, the emphasis will be on providing practical knowledge and a hands-on experience in learning.

The Center will further assist manufacturers by encouraging them to undertake demonstration projects involving new technologies. Productivity Center staff will provide engineering and analysis expertise for the demonstrations and the host company will be responsible for additional engineering, installation, and operations. Other organizations, trade groups or additional private companies will then be solicited to finance demonstrations of the innovative processes.

For further information on the Manufacturing Technology Center activities contact: Rick Thomas, Manufacturing Technology Center, Georgia Tech, Atlanta, Ga. 404-894-3830.

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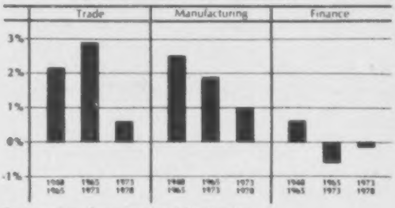
Productivity Trends

The U.S. Bureau of Labor Statistics has announced that productivity in the private business sector declined 3.1% in the second quarter of 1980, the sixth consecutive quarter of declining output per hour for all persons in this sector. This reflects a 12.5% decline in output, which is the largest drop recorded since 1947.

Changes in Total-Factor Productivity, 1948-78



Source: American Productivity Center.

PRODUCTIVITY
IN ACTION
GEORGIA PRODUCTIVITY CENTER
GEORGIA TECH ENGINEERING EXPERIMENT STATION, ATLANTA, GA

April 1981 Vol. 2 - Number 2

Human Productivity

A company's employees are one of the best resources available for reducing cost, increasing efficiency, and improving productivity. In most companies, this resource remains untapped or underutilized. At the Georgia Productivity Center (GPC) the role of human performance in improving productivity is being addressed by the Human Resources Group of the Economic Development Laboratory. The Human Resources Program is designed to provide assistance to businesses to maximize the effective utilization of their employees. Programs have encompassed a wide variety of work areas including management and supervisor effectiveness, production quality and quantity, worker motivation, absenteeism and tardiness, training, and sales effectiveness.

At the GPC the major Human Resource emphasis is on increasing productivity through improvement in performance management systems. Programs of productivity improvement are implemented by the staff of the Human Resources Group with expertise in both industrial psychology and industrial engineering. This team approach enables a broad-based, organization-wide program of productivity improvement which addresses all relevant aspects of human resource productivity in the organization.

The implementation of a typical productivity management program begins with a performance audit, i.e., an assessment of the extent to which the human resources of an organization are being utilized to the greatest advantage. This audit also aids in identifying areas where improvements in performance would be most cost-effective for the organization.

From this audit, a program is designed to improve qualitative and/or quantitative aspects of performance in one or more areas identified in the audit. Programs are developed in areas such as:

- Setting objectives and methods to attain them
- Performance assessment and evaluation

Performance feedback improves human resources productivity.

- Compensation systems and motivation of performance
- Design and development of training
- Organizational structure and communication systems
- Job satisfaction analysis

These programs are then implemented in conjunction with the management of the firm to insure successful follow-up. In most cases, this will involve on-site training of management personnel as well as workers in various aspects of the performance management program.

It is important for management to increase their awareness of the changes that are occuring in the work force as a result of the change in the work ethic and employee value systems. The GPC is available to assist your organization develop an understanding of needs, objectives, and benefits of a Human Resources Productivity Program. For assistance contact the Georgia Productivity Center, EES, 404-894-3404, Atlanta, Georgia 30332.